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OBSTETRICS.

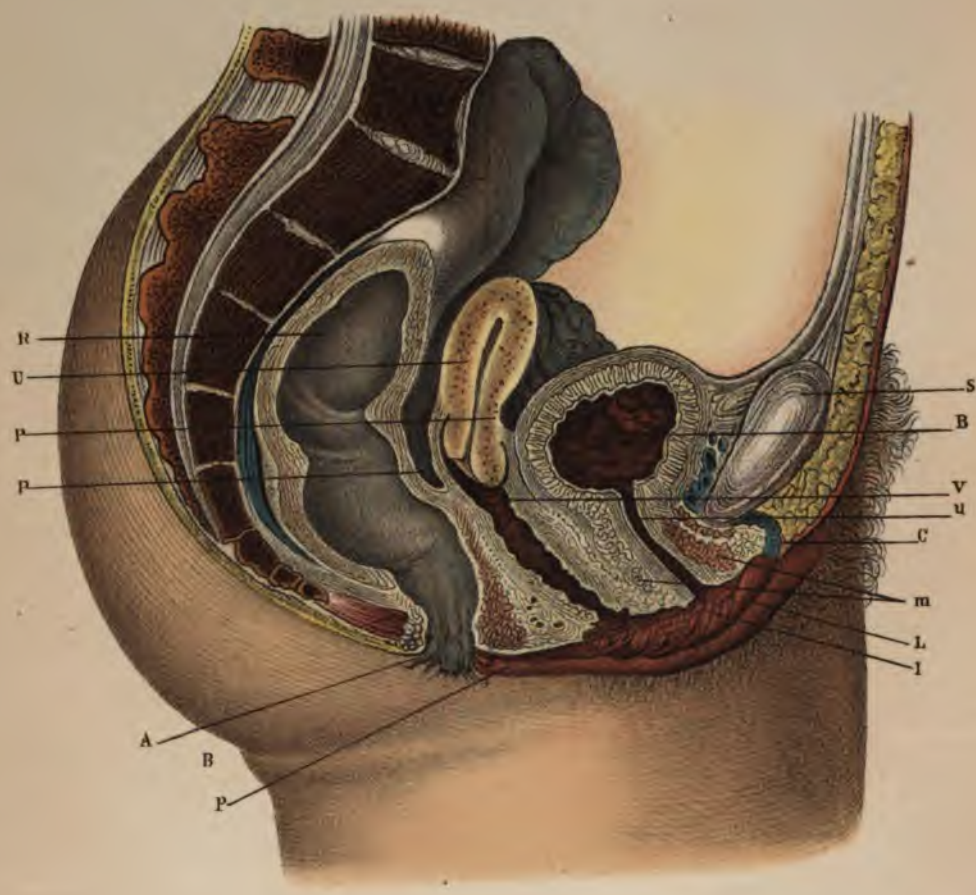
CAZEAUX AND TARNIER.

EIGHTH AMERICAN EDITION.

WITH APPENDIX BY PAUL F. MUNDÉ, M.D.,
AND NEW ILLUSTRATIONS.

IN TWO VOLUMES.

Plate I.



For Explanation see Page 92.

CAZEAUX AND TARNIER.

THE

THEORY AND PRACTICE

OF

OBSTETRICS;

INCLUDING DISEASES OF PREGNANCY AND PARTURITION, OBSTETRICAL OPERATIONS, ETC.

BY P. CAZEAUX,

MEMBER OF THE IMPERIAL ACADEMY OF MEDICINE, ADJUNCT PROFESSOR IN THE FACULTY OF MEDICINE, PARIS, ETC.

REMODELLED AND REARRANGED, WITH ADDITIONS AND REVISIONS,

BY S. TARNIER,

PROFESSOR OF OBSTETRICS AND DISEASES OF WOMEN AND CHILDREN IN THE FACULTY OF MEDICINE, OF PARIS.

THE EIGHTH AMERICAN EDITION.

EDITED AND REVISED BY ROBERT J. HESS, M. D.,

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WITH AN APPENDIX,

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WITH CHROMO-LITHOGRAPHS, LITHOGRAPHS AND OTHER FULL-PAGE PLATES, AND ONE HUNDRED AND SEVENTY-FIVE WOOD ENGRAVINGS.

VOLUME I.

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1886.

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PREFACE TO THE NEW EDITION.

In offering this new American edition of the classical work of Cazeaux and Tarnier to the profession, an apology is scarcely necessary. The previous editions have long since been exhausted, and although references to it in the pages of medical literature are frequent, most of the works upon the science and art of obstetrics which since then have been favorably received by the profession have gleaned much of their worth from its valuable teachings. The student of less elaborate text-books is likely, at the present day, to overlook the foundation principles upon which the science has been built, of which these distinguished authors have been for many years the honored teachers.

The present, with slight omissions, embraces all that was originally contained in previous American editions.

A later French edition, and also an Italian, issued during the past year, the latter with notes by Chiara, Morisani, Tibone, and Porro, have been consulted in its preparation, and we trust it will be found to contain the newest observations in obstetrical science made possible by the advance in every department of knowledge relating thereto.

We have been careful to avoid any change in the principles of practice as taught by Cazeaux and Tarnier, deeming the acceptance of them by the profession in the past, and the frequent reference to them by authors of the present, as the most certain test of their value, while the latest contributions of the present time in each department of the science have been carefully and freely introduced, due credit being given, so that this edition will reflect the best practice of the best authorities, and be a complete guide to the student and a source from which the profession may continue to draw rich suggestions in this, the highest branch of the science and art of medicine.

ROBERT J. HESS, M. D.

Philadelphia.

PREFACE TO THE FRENCH EDITION.

THE sixth edition of this work was almost exhausted, when its author, in the full strength of years and talent, was suddenly struck down by the disease which very soon proved fatal. In departing, Cazeaux left a name beloved of physicians and students, and respected by all. The success of his work on obstetrics had greatly contributed to extend his reputation and scientific authority. Inasmuch, therefore, as the stoppage of its publication would deprive the medical public of a work which, for a long time, has justly been ranked first amongst classical books, both Cazeaux's family and his editor concurred in the opinion that a new edition ought to be published.

A classical book soon grows old in these days, and it was found impossible to bring out a new edition without subjecting it to the alterations demanded by the progress of science. I was charged with its preparation, and accepted the honor of the task with a full appreciation of its difficulties. I had never been Cazeaux's pupil, but his book was the first from which I had studied obstetrics, and I had been accustomed to see it in the hands of all my fellow-students, and, at a later period, of my pupils also. Independently, therefore, of my personal observation, I was in a position to become acquainted with its character through others. Thus, together with merited praise, I sometimes also listened to criticisms of its details, and profited by all I heard.

I was left at liberty to remodel the work according to my judgment, to make the alterations which seemed to be required, to suppress some passages and to introduce new ones. Out of respect to Cazeaux's memory, it was decided that the printing should be done in two kinds of type; the larger for the old text, and the smaller for what I had myself written.

The reader will readily distinguish what belongs to Cazeaux and what to myself, but the work has been resolved into a homogeneous body without contradictory annotations. This last result could not

possibly have been attained without retouching the old text, by which a new direction and meaning has been sometimes given to the original ideas. Should it be desired to know certainly what Cazeaux's opinions were, it will, therefore, be necessary to consult an old edition.

Especially have I made it a duty not to change the spirit in which the work had been conceived; therefore I can say with Cazeaux, that, "After a work has passed through several editions, a preface is hardly needed, for its object is then sufficiently well known. The present is more particularly intended for the use of students of medicine and midwife-students, although general practitioners may also, perhaps, gain something by its perusal, for I have endeavored to make it a condensed summary of the leading principles established by the masters of our art, and for that purpose have drawn from all the works published down to the present day. My position in the lying-in hospitals has enabled me to test the value of the doctrines put forth by former authors; and I have adopted as true all which my daily experience has confirmed, and have rejected unhesitatingly, from whatever source they came, all such as were disproved by the numerous cases brought under my observation, confining myself to quoting, without comment, those whose value I have been unable to determine.

"Although this work resembles, in its general arrangement, most of those published on the same subject in France, it differs from them essentially in the main; for I have adopted almost wholly the views of Professors Nægèle, P. Dubois, and Stoltz, which are not found clearly expressed in any of our classical books. I have also extracted freely from the learned treatise of Professor Velpeau, whose vast erudition has greatly facilitated my bibliographical researches; from the course of my former teacher, Professor Moreau; from the excellent articles of Désormeaux, of Dugès, and of Guillemot; from the classical works of England and America, such as those of Burns, Campbell, Merriman, Ramsbotham, Dewees, Meigs, and Rigby; and from the treatises of Peu, Delamotte, Levret, Smellie, Baudelocque, Gardien, and Capuron. I have also consulted with advantage the manual recently published by my friend, Dr. Jacquemier; also, the memoirs of Simpson, Tyler Smith, Depaul, Devilliers, &c. I may be permitted also to express publicly my thanks to M. Coste, for his great kindness in allowing me to study his beautiful collection in the College of France, and to borrow several figures from the magnificent work which he is now publishing. Lastly, it will be seen how highly I value the eminently practical writings of Madame Lachapelle. In a word, I have selected from all sources

whatever bears the impress of truth. In the sciences of observation, a new work is necessarily enriched by the labors of all antecedent writers; and therefore, its greatest merit consists in collecting its scattered materials, and forming out of them a body of doctrine, which it illustrates in the clearest and simplest manner possible. Such is the end I have endeavored to attain; and the medical public, and students especially, must judge whether I have succeeded in the attempt.

"But few quotations have been made, though their number might have been greatly increased; but I wished to avoid the charge made by most students against one of our best classical works. However, I have felt bound to refer to living authors whenever I have introduced a new theory, or any particular procedure, which emanated from them; and besides, as the professorate may be deemed a mode of publicity, I have respected the right to the original ideas which I have heard emitted by Professor Dubois; and his name will be found scrupulously associated with all the opinions emanating from him.

"Notwithstanding a spurious copy published in Belgium, and several translations into foreign languages, the large editions of the work first published were rapidly exhausted. So favorable a reception made it obligatory upon me to neglect nothing which could render this edition worthy of the reputation of its predecessors. I have, therefore, reviewed and corrected all parts of it with scrupulous care."

The plan of the present edition has been so greatly modified that it may be regarded as altogether new, the order followed being that which I long since adopted for my course of lectures, as the most natural and the best. The chapters are grouped into eight principal parts. Part first is devoted to the female organs of generation. The pelvis is first studied by describing separately each of its component parts, afterwards considering them as a whole, and pointing out carefully whatever peculiarities it may present as to form, direction, and size; then we pass immediately to the anatomical description of the external and internal organs of generation. It will be seen that I have here profited by M. Sappey's recent researches in regard to the structure of the ovary, and those of Dr. Helie (of Nantes) in regard to the structure of the uterus. The physiology of the genital organs is now so intimately connected with their anatomical arrangement that it is impossible to describe them fully without speaking at the same time of their functions. The phenomena which they exhibit at certain periods are also very properly regarded as the preludes of generation, making their preliminary study

indispensable to all who would understand the changes which these organs undergo during the puerperal condition.

The genital apparatus of the female having been studied in the non-pregnant condition, we examine, in the second part, those very numerous and important changes which they undergo during gestation, and shall often have occasion to quote the many works of Robin on the uterine mucous membrane, the decidua, and the placenta. We afterwards study the first cause of all of these changes, to wit, the fœtus and its appendages, which are traced through the various stages of their development. From this examination we deduce the signs of pregnancy.

Having acquired these preliminary notions, we are in a condition to enter upon the subject of labor in the third part of the work. In the process of parturition we distinguish two orders of phenomena: one purely physiological and expressive of the vital action called into play in order to expel the fœtus; the others, purely mechanical, and constituting the mechanism by which this expulsion takes place.

We have given great latitude to the description, and especially to the explanation of the mechanism of natural labor, and think that we have succeeded in explaining certain facts which, hitherto, had only been pointed out. New views have also led us to describe six principal stages in the mechanism of all the presentations. After the labor, properly so called, comes the study of the delivery of the after-birth, and of the puerperal state; this part including afterward the subject of the attentions to be given to the woman during and after labor, as also an article devoted to apparent death of new-born children.

I have also greatly extended the pathology of pregnancy, to which the entire fourth part is devoted. Chapters entirely new will be found in it on the diseases of pregnancy, the alterations to which the placenta is subject, and the death of the child during intra-uterine life. Thus, I hope that I have supplied an omission that was to be regretted.

In the fifth part, which is devoted to difficult labor, we treat in detail of deformities of the pelvis and all other causes of dystocia, the way in which each operates, their situation in the mother, the child or its appendages, the signs whereby their presence may be detected, the indications which they present, and the means of remedying them. In the study of the accidents which are liable to complicate labor, I have profited by all the works published of late years, and in the account of hemorrhage, puerperal convulsions, and the indications which they present, will be found some new considerations. To fill up properly

the outline which we had traced, it became necessary to treat carefully of artificial delivery of the after-birth, and the accidents to which it is liable.

I have introduced a sixth part, devoted to obstetrical therapeutics, which includes two chapters only: the first being devoted to ergot, and the second to the effect of a debilitating regimen and a certain course of medication upon the development of the child during intra-uterine life.

The seventh part comprises a discussion of the use of anæsthetics in labor, an account of the use of the tampon and of all the obstetrical operations, rendered in a degree of detail proportioned to the interest which attaches to them.

The eighth and last part, is exclusively devoted to the hygiene of the child from birth to the period of weaning.

It would be impossible to point out all the additions which are scattered through the work, but they are very many. Everywhere have I accorded to the views of Professors Depaul and Pajot, as also to the views of all contemporaneous authors, the prominence which they deserve. I hope therefore that this book, which is, so to speak, a new one, will be found to represent all the most important knowledge which we possess pertaining to the obstetric art.

TARNIER.

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THE THEORY AND PRACTICE

OF

OBSTETRICS.

PART I.

OF THE FEMALE ORGANS OF GENERATION.

THE female organs subservient to generation are: the *ovaries*, the principal function of which is the secretion of the ovule or female germ; the *Fallopian tubes*, designed to receive the ovule, and conduct it into the cavity of the uterus; the *uterus*, a kind of receptacle, whose office it is to contain the fecundated germ during its period of development, and to expel it immediately afterward; finally, the *vagina*, a membranous canal extending from the neck of the uterus to the external genital parts. Most of these organs are situated within a large cavity, the walls of which are composed of bones and soft parts; the cavity is termed the *cavity of the pelvis*, or *pelvic cavity*. On account of the importance of the pelvis as an organ both of protection and transmission, we shall, with it, begin the study of the organs of generation.

CHAPTER I.

OF THE PELVIS.

THE *basin*, in Latin, *pelvis*, is a large, irregular, bony cavity, a sort of curved canal, which terminates the trunk inferiorly, and sustains it by its posterior part. It is placed directly upon the lower extremities, which afford it points of support, and to which, in the erect posture, it transmits the weight of the upper portions of the body. Its position in an adult of ordinary stature is, in general, about the central part of the whole trunk. In the infant at term, and more especially during the intra-uterine life, it is much below this point; and at a certain period of fœtal existence, when the lower extremities resemble as yet but little nipples, it even occupies the inferior portion of the body. Especially should the accoucheur study

the pelvis in its totality and in its relations with the great function which it subserves. Now as the best way of understanding a whole is to decompose it, and study separately its constituent parts, we shall proceed at once to consider individually the bones which enter into the composition of the pelvis.

ARTICLE I.

BONES OF THE PELVIS.

The bones which together constitute the pelvis are: the *sacrum*, and the *coccyx*, both placed behind and on the median line, and the *ossa innominata* or *coxal bones*. These last are in pairs, being situated at the sides and articulating with each other in front.

§ 1. Of the Sacrum.

This is a symmetrical, triangular bone, which is curved forward at its lower part, and is placed at the posterior part of the pelvis, where it appears like a wedge, forced in between the two ossa innominata, immediately below the vertebral column, and directly above the coccyx. It is traversed longitudinally by the sacral canal (a continuation of the vertebral canal), and, relatively to the axis of the body, it is directed from above downwards, and from before backwards; hence the column represented by it forms an obtuse angle with the lumbar vertebræ, being salient in front, and receding behind. This point is called the *promontory*, or the *sacro-vertebral* angle. Besides this direction, the sacrum is curved upon itself from behind forwards, so as to present an anterior concavity, the hollow of the sacrum: this curvature is generally much more marked in the female than in the male.

Anatomists describe the bone as having two faces, two borders, a base, and an apex.

1. The *spinal*, or *posterior face*, is convex, rough, and very irregular, presenting on the median line three, four, or five prominences, the longest of which are above, and continuous with the ridge formed by the series of spinous processes of the vertebræ; lower down, the sacral canal is terminated as a triangular gutter, being bounded laterally by two tubercles, called the *cornua* of the sacrum; upon each side of, and close to the median line, a large furrow exists, at the bottom of which the four posterior sacral foramina are seen, communicating with the vertebral canal, and serving to transmit the nerves of the same name. Outside of these foramina we find a series of elevations, apparently analogous to the transverse processes of the vertebræ; and above them two irregular fossæ, into which the posterior sacro-iliac ligaments are inserted.

2. The *pelvic*, or *anterior face*, is smooth and concave, and is traversed by four prominent transverse lines, the remnants of the sutures between the different pieces that composed the bone in early infancy, and which served to separate some superficial, transverse, and quadrilateral grooves found there, from each other. Sometimes the first of these prominent lines

is so well marked as to be mistaken, when practising the touch, for the sacro-vertebral angle.

The anterior sacral foramina, four in number, are found nearer the lateral margins; they communicate with the sacral canal, and transmit the anterior branches of the nerves of the same name. Beyond the foramina is an unequal surface for the attachment of the pyramidal muscles.

3. The *borders* of the sacrum may be divided into two portions. 1. The superior, being very thick, presents, on its anterior half, a semilunar articular facet for joining with the coxal bone, and on its posterior part an excavation, and some rough projections for the attachment of the sacro-iliac ligaments. The other, or inferior portion, is quite thin, and is occupied by the insertion of the sacro-sciatic ligaments.

4. The *base* is directed upwardly and a little in front, and has its greatest diameter transversely. An oval facet, more or less inclined backwards, surmounts it at the middle, whereby the bone is articulated with the last lumbar vertebra. Upon each side is seen a smooth surface, which is concave transversely, and convex from before backwards. These surfaces incline forwards and are continuous with the iliac fossæ, being covered, in the recent subject, by the anterior sacro-iliac ligaments. They are separated from the anterior face of the sacrum by a rounded border, which forms, as we shall hereafter learn, the posterior part of the superior strait. The two surfaces constitute the *wings of the sacrum*. Behind, are found the upper orifice of the sacral canal, and the two articular processes of the first piece of the sacrum.

5. The *apex* of the sacrum is directed downwards, and a little backwards; presenting an oval facet for the articulation of the coccyx.

6. The *sacral canal*, hollowed out in the thickness of the bone, is the termination of the vertebral canal; being triangular and broad superiorly, it becomes narrow and flattened at its inferior part, where it degenerates into a gutter, that is converted into a canal by the ligaments. This lodges the sacral nerves, and communicates both with the anterior and the posterior sacral foramina.

Fig. 1.

Anterior surface of the sacrum.

Fig. 2.

Posterior surface of the sacrum.

Fig. 1. A. Ala or wings of the sacrum. B. Articular processes. C. Anterior sacral foramina. E. Points of attachment of the right pyramidal muscle.

Fig 2. A. Ridge formed by the spinous processes. B. Posterior sacral foramina. D. Articular processes.

The sacrum, although quite thick, is a very light and spongy bone. Besides, it is pierced by a great number of foramina, and traversed by a central cavity, which serve to diminish its weight still more.

It is formed of five principal pieces (false sacral vertebræ), sometimes of six, and in one case, seven were observed (Pauw). In Sœmmering's cabinet are three specimens which present but four pieces.

The *development* of the sacrum is analogous to that of the vertebræ, and takes place from thirty-four or thirty-five points of ossification, arranged in the following manner:

1. Five of them, placed one over the other, occupy the anterior and middle parts. 2. In each of the interspaces which separate these, two small osseous laminæ are developed some time after birth, which seem to form their articular surfaces. 3. Ten are situated in front and upon each side of the latter, that is, one for each lateral portion of the four or five primitive bones. 4. And behind them six others are developed, between which: 5. There appear three or four that correspond with the spinous processes, or their laminæ; and 6. Lastly, there is one upon each side above the iliac surface, for the articular facet.

§ 2. The Coccyx.

This name is given to an assemblage of three or four, occasionally five little bones, united with each other on the median line of the body, and apparently suspended at the point of the sacrum, of which, indeed, they appear to be only a movable appendage, continuing its line of curvature forwards.

Fig. 3.

Posterior surface of the coccyx.
Fig. 3. A. Cornua of the coccyx. B. Apex.

Fig. 4.

Anterior surface of the coccyx.
Fig. 4. A. Cornua of the coccyx. B. Apex.

M. Cruveilhier declares that he has known it, in some cases, to form a right angle or even an acute one with the sacrum. As a whole, the coccyx represents a triangular and symmetrical bone.

1. Its *spinal*, or *posterior face*, is convex and irregular, and is only separated from the skin by the posterior sacro-coccygeal ligament.

2. Its *pelvic*, or *anterior face*, is smooth and slightly concave, and lies in contact with the termination of the rectum, which rests upon it. Like the preceding bone, it is marked by certain transverse grooves, corresponding with the intervals which had, for a long period, separated its different pieces.

3. Its *two lateral borders* are quite irregular, and are occupied by the attachments of the anterior sacro-sciatic ligaments, and the ischio-coccygeal muscles.

4. Its slightly concave *base* presents, above, an oval surface, which articulates with the apex of the sacrum, and behind, two little tubercles called the *cornua* of the coccyx.

5. The *apex* is rounded, irregular, and sometimes bifurcated, affording attachment to the levator ani muscle.

The coccyx is developed from four or five centres of ossification, that is, one for each of its parts.

§ 3. The Coxal Bone, Haunch Bone, or Os Innominatum.

This is a non-symmetrical, quadrilateral bone, curved upon itself, as if twisted in two different directions, contracted in its middle, and of a very irregular figure. The pair occupy the lateral and anterior parts of the pelvis. It presents an internal and external face, and four borders, for our consideration.

1. The *external*, or *femoral surface*, is turned outwards, backwards, and downwards, at its superior part, while inferiorly, it looks forward.

At its superior and posterior portion is seen an unequal, narrow, and convex surface, affording origin to the gluteus maximus muscle, and terminated below by a slightly elevated circular ridge, called the *superior curved line.* Beneath this, there is a larger surface, which is concave behind, narrowed in front for the insertion of the gluteus medius muscle, and bounded by a slight ridge below, called the *inferior curved line;* still lower, there is a third extensive and convex surface, serving for the attachment of the gluteus minimus muscle. All that portion of the femoral face just described forms a large fossa, alternately concave and convex, bearing the name of the *external iliac fossa.*

Towards the front, the external face presents the cotyloid cavity or the acetabulum, at its superior part; and a little more in advance and below, the sub-pubic, or *obturator foramen.* This opening is triangular, with rounded angles; its long diameter is inclined downwards and outwards, and its circumference is sharp and irregular, presenting above a groove, directed obliquely from behind forwards and from without inwards, through which the obturator vessels and nerves pass out. A fibrous membrane that subtends the foramen is attached to its periphery, except in the immediate vicinity of the groove.

Upon the upper side of the obturator foramen, between it and the median line, there is a concave or nearly plane surface for the origin of several muscles.

Fig. 5.

External surface of the os innominatum.

A. External iliac fossa. B. Crest of the ilium. C. Anterior superior spine of the ilium. D. Anterior inferior spine of the ilium. E. Horizontal branch of the pubis. F. Posterior superior spine of the ilium G. Posterior inferior spine of the ilium. H. Cotyloid cavity. I. Ischium. K. Sub-pubic or obturator foramen M. Ischio-pubic ramus. C. Descending branch of the pubis.

2. The *abdominal*, or *internal face*, is directed forwards at its upper part, and backwards at the lower. It may be divided into two portions, the superior of which is characterized by a large excavation, called the *internal iliac fossa*, by a semilunar articular surface found just behind this fossa, and called the *auricular facet*, and still more posteriorly, by some rugosities, analogous to those found on the articular faces of the sacrum.

The superior portion is terminated below by a large, rounded, and concave line, which separates it from the other moiety. The latter, or inferior portion, presents behind a nearly triangular plane surface, which corresponds to the cotyloid cavity and to the body of the ischium; near its middle, we find the obturator foramen, and in front, the internal face of the pubis and of the ischio-pubic ramus.

Fig. 6.

Internal surface of the right os innominatum. A. Internal iliac fossa. B. Anterior superior spinous process of the ilium. C. Crest of the ilium. D. Posterior superior spinous process of the ilium. E. Posterior inferior spinous process of the ilium. F. Articular surface. G. Spine of the ischium. H. Tuberosity of the ischium. I. Sub-pubic or obturator foramen. K. Ischio-pubic ramus. M. Ilio-pectineal eminence. N. Spine of the pubis.

3. *Borders.* These are four in number. The posterior one has a very irregular shape, being oblique from above downwards, and from without inwards. The *posterior superior spinous process* is found at its junction with the superior border. This prominent, well-marked eminence is separated by a rough margin from another though less voluminous one, called the *posterior inferior spinous process.*

Below this last apophysis, the student will observe a very deep notch, which contributes to the formation of the great sciatic foramen, and is terminated below by a triangular, pointed projection, bearing the title of the *spine of the ischium.* This process is more or less prominent in different individuals, and is sometimes directed inwards. A groove is seen just beneath it, in which the tendon of the obturator internus muscle plays; this groove is a part of the *lesser sciatic* notch; and lastly, this border terminates at the tuberosity of the ischium.

The anterior border is concave, oblique above, and nearly horizontal in front. The *anterior superior spinous process* is formed by its union with the superior border. A considerable depression exists under this apophysis, which separates it from another one, called the *anterior inferior spinous process.* Then we find a groove just under this elevation, for the gliding of the conjoint tendon of the psoas magnus and the iliacus internus muscles; which groove is bounded, in front and below, by the *ilio-pectineal eminence.* And lastly, the border is terminated by a triangular horizontal surface, which is directed downwards and forwards, and is broader externally than internally, and by the spine and angle of the pubis.

The *superior border* or *crest of the ilium* is thick, convex, and inclined outwards, excepting at its posterior part, where it looks slightly inwards—

being twisted, in its course, somewhat like an italic *f*. Anatomists have subdivided it into the external and internal lips, and the intervening space. The anterior superior spinous process bounds it in front, and the posterior superior one behind.

The *inferior border* is shorter than either of the others; it presents, however, three parts for study. There is an oval surface above, for articulating with its fellow of the opposite side, forming the symphysis; below, it is terminated by the tuberosity of the ischium, and in the middle, we find the *ischio-pubic ramus;* this is a sharp ridge, formed superiorly by the descending branch of the pubis, and inferiorly by the ascending portion of the ischium.

The coxal bone is developed from the principal centres of ossification, which appear at the same time in the iliac fossa, the tuberosity of the ischium, and in the pubis. Owing to this mode of growth, it has been customary to divide the os innominatum into three portions: the superior one, styled the *ilium*, forms, in a great measure, the contour and prominence of the hip; the *pubis*, being anterior, supports the genital organs; and the inferior one, which sustains the body when seated, is named the *ischium*.

Several years after birth, an osseous lamina resting upon the superior border of the bone, is developed to form the iliac crest, whilst a similar layer embraces the tuberosity of the ischium, and extends to its ramus; at the same time, a third centre of ossification appears for the anterior inferior spinous process of the ilium, and a fourth forms the angle of the pubis.

ARTICLE II.

ARTICULATIONS OF THE PELVIS.

[The four bones just described are united by four articulations peculiar to the pelvis; one in front for the two pubic bones, two behind for the iliac bones and the sacrum, and that of the coccyx with the sacrum. All these articulations are usually termed symphyses; thus the articulation of the two pubic bones is styled the pubic symphysis, the junction of the iliac bone with the sacrum is called the sacro-iliac symphysis, and the connection of the sacrum and coccyx the sacro-coccygeal symphysis.

It should be observed, however, that the symphyses or amphiarthroses are characterized by flat articular surfaces, united by a layer of fibrous tissue which allows a bending motion without any sliding of the bones upon each other. Now this sliding motion exists in the pelvic articulations of the female. It is, therefore, a mistake to classify them amongst the amphiarthroses, and only by an abuse of language can they continue to be called symphyses. Lenoir's researches prove that some anatomists were near the truth in considering them as arthrodia. In twenty-two female subjects between the ages of eighteen and thirty-five years, Lenoir found that the four pelvic articulations are formed by the contact of surfaces covered with cartilage and lined with synovial membranes; they present, therefore, all the characteristics of arthrodia, and have a simple, sliding motion.

To the four articulations proper, of the pelvis, it is well to add in this connection. the articulation of the sacrum with the spinal column. Here we have really one of the amphiarthroses or symphyses.

The description of the sub-pubic ligament completes the history of the ligamentous connections of the pelvis.]

§ 1. Articulation of the Pubis.

This articulation is formed by the approximation of the oval surfaces occupying the upper part of the lower border of the coxal bones. These surfaces are slightly convex and unequal, and are covered with a cartilaginous lamina which fills up the inequalities. The convex shape and the direction of their faces are such, that they only come into contact for an inconsiderable extent at their internal or posterior part, and hence they leave above, in front, and below, an open space, which is the more considerable, in proportion to the distance from the centre of the joint. The articulating surface of the two cartilages is a little facet, about six or eight lines in its vertical diameter, by two or three in its transverse one. This facet is smooth, and furnished with a synovial membrane, which is the more lubricated with synovia as the female approaches the period of labor. A considerable thickness of the interpubic ligament fills up the interval which exists between the other points of these articular surfaces.

This *interpubic ligament* is formed of a very dense fibrous substance. It has the form of a wedge, with the point forced down between the bones and the sides adhering to the rough surfaces fronting the articulation. Two planes of fibres are discoverable in it; the deeper ones, which pass from one iliac bone to the other, and are shorter in proportion to their depth, are crossed, and disposed in several layers. They constitute the *interpubic ligament* properly so called. The others, which are more superficial, are parallel, and pass obliquely from within outwards and from above downwards. Beginning at the upper part of the articulation they spread in descending, until they are finally divided into two bundles, which become lost in front of the branches of the pubic arch by mingling with the periosteum of the bones and the tendons of the muscles inserted in the vicinity. These form the *anterior pubic ligament.*

The uppermost portion of the anterior pubic ligament seems to take its origin in the fibrous cord which is inserted on the spine of the pubis, and which cushions, so to speak, the upper edge of that bone, in such a way as to efface its inequalities. It constitutes the *superior pubic ligament.*

Lastly, at its lowest part, the anterior pubic ligament assumes the form of a thick triangular bundle occupying the summit of the pubic arch, and fixed by its lateral edges to the upper and internal part of the two branches thereof. This ligament, called the *triangular*, or *sub-pubic ligament*, pre-

Fig. 7.

Fig. 8.

Horizontal section through the articulation of the pubis. Posterior view of the articulation of the pubis.

Fig. 7. A. Synovial membrane. B. Articular cartilages. C. Inter-pubic ligament. D. Section of the bones.

Fig. 8. A. Posterior projecting pad. B. Sub-pubic ligament. C. Section of horizontal branch of pubis D. Section of ischio-pubic ramus.

sents a rounded base, which completes the arch of the pubes by giving it a regular curve calculated to facilitate the exit of the fœtus.

Thus, we have three anterior pubic ligaments, a superior pubic and a sub-pubic ligament, all of them representing a spreading out of the inter-osseous ligament. Behind the symphysis, the fibro-cartilaginous substance forms a sort of projecting pad, which occupies the middle part only, and disappears from above downwards.

Finally, the ligamentous arrangement of the articulation is completed by the *posterior pubic ligament*, composed of fibres extending transversely from one pubis to the other, above the projection just noticed. This ligament, which is very thin, and of moderate strength, forms the posterior lining of the synovial membrane.

§ 2. Sacro-iliac Articulations.

This articulation is formed by the junction of the semilunar facets, which were pointed out in describing the border of the sacrum and the internal face of the ossa ilia.

Both these facets are covered with a diarthrodial cartilage, which is closely adapted to the inequalities they present; that, however, which pertains to the sacrum, being always much thicker than the layer which belongs to the iliac bones. The latter is so thin, that its existence has been denied. These cartilages are covered with a synovial membrane, which secretes quite abundantly a viscid and transparent synovia. But, when the female has passed the prime of life, this fluid often concretes, and becomes disposed in isolated flakes upon the articular surfaces, — a fact which has caused its true nature to be misunderstood.

A very limited sliding motion is all of which this articulation is susceptible. The bones are held together by the following ligaments:

1. The *posterior*, or *great sacro-sciatic ligament*, is found at the posterior inferior part of the pelvis. It is triangular, thin, flattened, and narrower in the middle than at the extremities. It arises by a large base from the posterior inferior spinous process of the ilium, the sacro-spinous ligament, the last of the posterior tubercles of the sacrum, and from the inferior part of the margin of this bone and border of the coccyx, and running outwards, downwards, and a little forwards, is inserted into the tuberosity of the ischium. Its fibres are arranged in such a way, that the internal ones cross the external about their middle.

2. The *lesser sacro-sciatic ligament* is smaller than the preceding, though nearly of the same form, and situated more in front. Within, it is broad, being partially confounded with the other, but arising a little more anteriorly upon the sides of the sacrum and coccyx; thence, it passes forwards and outwards to be inserted into the spine of the ischium.

The sacro-sciatic ligaments convert the two sciatic notches into foramina. They not only serve to unite the sacrum to the ilium, but also contribute to the formation of the parietes of the pelvis.

3. The *posterior sacro-iliac ligament* is a collection of yellow, elastic, fibrous bundles, intermixed with fatty pellets, which fill up the rough

§ 1. Articulation of the Pubis.

This articulation is formed by the approximation o
occupying the upper part of the lower border of the
surfaces are slightly convex and unequal, and are co
ginous lamina which fills up the inequalities. The co
direction of their faces are such, that they only com
inconsiderable extent at their internal or posterior
leave above, in front, and below, an open space, w
siderable, in proportion to the distance from the co
articulating surface of the two cartilages is a little
lines in its vertical diameter, by two or three in
facet is smooth, and furnished with a synovial
more lubricated with synovia as the female appro
A considerable thickness of the interpubic liga
which exists between the other points of these a

This *interpubic ligament* is formed of a very
has the form of a wedge, with the point forced
the sides adhering to the rough surfaces fro
planes of fibres are discoverable in it; the dee
iliac bone to the other, and are shorter in
crossed, and disposed in several layers. The
ment properly so called. The others, wh
parallel, and pass obliquely from within ou
wards. Beginning at the upper part of
descending, until they are finally divided
lost in front of the branches of the pubi
osteum of the bones and the tendons of th
These form the *anterior pubic ligament.*

The uppermost portion of the anterio
origin in the fibrous cord which is inse
which cushions, so to speak, the upper
to efface its inequalities. It constitute

Lastly, at its lowest part, the anteri
of a thick triangular bundle occupyi
fixed by its lateral edges to the upper
thereof. This ligament, called the

Fig. 7.

Horizontal section through the articulation o
Fig. 7. A. Synovial membrane. B. Artic
Fig. 8. A. Posterior projecting pad. B.
D. Section of ischio-pub ramus.

supposed to resemble those
from them materially in being a
of the oval surface of the
the coccyx; the middle of the
a depression in the centre of the
ar face of the coccyx is directed
these surfaces are rather thinner at
They are provided in the adult
is supposed by M. Lenoir to be
of the coccyx upon the sacrum, since
under eighteen years of age.

of a few parallel fibres,
sacrum to the corresponding

is flat, triangular, broader
Arising from the margin of the
ends to, and is lost upon, the
also aids in completing the canal

ly the anatomical arrangement to
sacrum is due, it was ascertained by
almost as frequently in the sacro-
the second piece of the coccyx with
simultaneously in both, whilst in few
connection of the second piece with the
urth.
ctions are similarly constructed. In all
of motion of the coccyx were changed,
less complete anchylosis of the articulation
yx, and of those between the bones of the
ove and below the one which preserved its
wherever situated, the movable articulation was
1. Of articular surfaces irregular in form but
which were incrusted with diarthrodial cartilages
novial membrane. 2. Of lax peripheral ligaments
the layers of fibrous substance covering the bones
ally, motion was possible in every direction.
that ossification is more frequent and rapid in the
sacrum and coccyx than in that between the first piece
the second; the third and fourth become fused very
fore easy to understand how the great mobility of the
articulations renders luxation possible in labor, whilst in
is, either fracture or a sudden separation of the united
occur.
pregnancy, the ligaments of the pelvic articulations become so
swelled by imbibition of fluid, as to render the mobility of the
surfaces very evident. This softening is very considerable in
, and may make walking, or even standing, impossible. (See
of Pregnancy.)

Sacro-vertebral Symphysis.

is produced by the junction of the sacrum with the fifth lumbar
ebra. It is a true amphiarthrosis, as are all the vertebral articulations.
takes place at three different points, viz., between the oval facet, seen at
middle of the base of the sacrum, and the inferior surface of the body
the last vertebra; and at the two articular surfaces found near the
rance of the sacral canal.

The modes of connection are, a fibro-cartilage (which is much thicker in

front than behind), the termination of the two anterior and posterior vertebral ligaments, the interspinous ligament, and lastly, the *sacro-vertebral ligament*, a short, very strong, fibrous bundle, which descends obliquely from the anterior inferior part of the transverse process of the last vertebra, downwards and outwards, towards the base of the sacrum, where it is inserted.

Further, a synovial membrane is found in the articulation between the oblique process of the sacrum and those of the vertebræ.

To these must also be added the ilio-lumbar ligament, which passes from the apex of the transverse process of the fifth lumbar vertebra to the thickest portion of the iliac crest; and the ilio-vertebral ligament formed of two fibrous bands, the superior of which arises from the middle and lateral part of the body of the last lumbar vertebra, and the inferior, from the inter-sacro-vertebral space; both are then spread out on the coxal bone.

§ 5. Obturator Membrane.

The obturator membrane still claims a description, in order to finish the history of the ligamentous apparatus of the pelvis. This, as has been remarked by M. Cruveilhier, like the sacro-sciatic ligaments already spoken of, is rather an aponeurosis serving to complete the pelvic walls, than a true ligament.

These resisting membranes are probably intended to diminish, in the hour of labor, the compression of the mother's soft parts, included between the infant's head and the osseous parietes of the pelvis, as also to favor, by their elasticity, the passage of the head through the pelvic excavation.

Obturator membrane.—This membrane subtends the foramen thyroideum, excepting at its superior part, where an opening exists, which converts the groove, intended for the passage of the obturator vessels and nerves, into a complete canal. Being inserted by its external semi-circumference into the corresponding part of the periphery of the obturator foramen, it is attached by its internal half to the posterior face of the ascending ramus of the ischium. Its surfaces afford origins for the two obturator muscles. This membrane is composed of aponeurotic fasciculi, which cross each other in every direction. (*Cruveilhier.*)

ARTICLE III.

OF THE PELVIS IN GENERAL.

Studied in its general aspect, the pelvis represents a cone, slightly flattened from before backwards; the base of which, being above, is at the same time inclined forwards, whilst the apex is directed downwards and a little backwards.

§ 1. External Surface of the Pelvis.

Anatomists have divided this surface into four regions: the anterior of which exhibits, on the median line, the front part of the symphysis pubis

which is directed from above downwards and from before backwards, at an angle with the perpendicular of some 15° to 20°; next (passing outwards) is a smooth surface, from which several muscles of the thigh arise, then the external obturator fossa, occupied in the recent subject by the muscle of the same name, and finally by the anterior half of the edge of the cotyloid cavity.

The posterior, bounded by the hinder part of the iliac crest, presents, on the median line, the ridge of the sacral spinous processes, the inferior opening of the vertebral canal, the union of the sacrum with the coccyx, and the posterior face of this latter bone.

The ten posterior sacral foramina, transmitting the nerves of the same name, are found in two deep gutters, on the sides. These grooves prolong the spinal gutters, and are occupied in the recent state by the commencement of the sacro-spinal muscles. The lateral regions may each be divided into two parts: one, the superior, is the external iliac fossa; the other, or inferior, offers, behind, the posterior aspect of the sacro-sciatic ligaments, and the plane of the notches or foramina bearing the same name; and, in front, the cotyloid cavity and the external face of the tuberosity of the ischium.

§ 2. Internal Surface.

The internal surface or cavity of the pelvis has been aptly compared to the basin of the ancient barbers. (*Vesalius.*) In fact, like those vessels, it has a superior part which spreads out freely, and is called the *great*, the *superior*, or the *abdominal* pelvis; and an inferior one, more contracted, bearing the title of the *little pelvis*, or *pelvic excavation.*

1. The *great pelvis* has a very irregular figure, and forms a species of pavilion to the entrance of the pelvis. Its walls are three in number: the anterior one is deficient in the dried skeleton, but in the living state it is supplied by the anterior abdominal muscles; its posterior parietes exhibit a notch in its middle, that is ordinarily filled up by the projection of the last lumbar vertebræ, which are usually left in connection with the pelvis, although in reality not forming any part of it. Two gutters are found on the sides of this eminence, occupied by the psoæ muscles; further outwards, the anterior part of the sacro-iliac symphyses appear, which constitute the boundaries between the posterior and lateral regions: these latter are constituted by the internal iliac fossæ, covered by the iliacus internus muscles.

2. The *lesser pelvis*, or *basin.* This forms a curved canal, larger in the middle than at its extremities, and slightly bent forward. If all the parts described as appertaining to the great pelvis be removed by the saw, as recommended by Chaussier, a species of ring will remain, whose circumference, being narrow in front and much broader behind, will furnish a correct idea of the shape of the pelvis. Four regions are found in this cavity also:

The *anterior* one is concave transversely, and is inclined upwards, having the posterior part of the pubic articulation near its middle: this is generally prominent, assuming the form of a longitudinal pad, which may in some cases project to the extent of from two to three-eighths of an inch. Towards

the sides a smooth surface appears, and then the internal obturator, or sub-pubic fossa, having, at its upper external part, the inner orifice of the sub-pubic canal, through which the external obturator vessels and nerves pass out from the pelvis.

It is not at all uncommon for females to complain during labor of severe cramps in the muscles of the upper internal part of one thigh. These pains result from the pressure made by the child's head upon those nerves, as it glides over this portion of the excavation.

The *posterior region* — constituted by the front face of the sacrum and coccyx — is directed downwards, and is concave from above, downwards. It consequently exhibits those peculiarities already noticed when describing the sacrum.

The *lateral regions* present two quite distinct portions: the anterior one is wholly osseous, corresponding to the back part of the cotyloid cavity, and to the body and tuberosity of the ischium. It is directed from above downwards, from behind forwards, and from without inwards.

The posterior one is formed by the internal face of the greater and lesser sacro-sciatic ligaments, and by the internal aspect of the great and small sciatic notches, converted by them into foramina; it has an opposite direction to the former. One of these foramina is larger and situated higher up than the other, and is of an oval form. The other is triangular, smaller, and more inferior. The pyramidal muscle, the great sciatic nerve, gluteal artery, and the internal pudic vessels and nerves, escape from the pelvis through the great sciatic foramen. The small sciatic hole is filled up by the obturator internus muscle, and the internal pudic vessels and nerves, which re-enter the pelvis in order to supply the perineum.

If two vertical sections be made, the one extending on the median line through the sacrum and the pubis, dividing the pelvis into two lateral halves, and the other at right angles to the first, dividing it into anterior and posterior halves, four equal parts or quarters of the pelvis will be thereby produced, which accoucheurs have designated as the *anterior* and *posterior inclined planes.* Desormeaux included only the lateral regions of the excavation, which he divided into two equal parts, in the composition of these planes: according to him, the anterior inclined planes are continuous with the anterior region; the posterior, with the front face of the sacrum; and the spine of the ischium is found at the point of union of these two. The direction of the inclined planes is always the same, whatever be the manner in which they are formed. That is, the anterior are directed from without inwards, from above downwards, and from behind forwards; the posterior, from without inwards, from above downwards, and from before backwards — in a word, in such a way as to resemble somewhat the four sides of a lozenge which is slightly curved in its length. By most authors, these inclined planes are supposed to play an important part in the mechanism of labor: for they imagine that their direction has an immediate influence upon the movements which the head of the fœtus performs in the excavation.

In anticipating that the description of the mechanism of labor hereafter

given will invalidate this assertion, we shall simply observe that the movements of rotation executed by the head, take place more frequently whilst the latter is strongly bulging out the perineum, and is so far below the inclined planes as scarcely to feel the influence of their direction, and further, that these motions often occur in an opposite direction.

The great and the lesser pelvis are separated from each other by a kind of horizontal circle, which has been designated by accoucheurs as the abdominal, or *superior strait*, the isthmus, or margin of the pelvis. Finally, the apex of the pelvis presents an opening that is limited by a circle, partly osseous, partly ligamentous, to which the name of the *inferior strait* has been applied. Consequently, these two straits are the extreme limits of the pelvic excavation.

§ 3. Of the Superior Strait.

The *superior strait* is formed, behind, by the sacro-vertebral angle, and the anterior border of the wings of the sacrum: outwardly, by the rounded margin that bounds the internal iliac fossa below; and in front, by the iliopectineal eminence and the horizontal ramus of the pubis, terminating at the symphysis of this bone. The abdominal strait has been variously compared to an ellipse, an oval, and to the heart of a playing-card. We may assert, however, with Chaussier, that its shape is that of a curvilinear triangle, the angles of which have been rounded off, and having its base behind and the apex in front.

It constitutes the entrance to the lesser pelvis, and is therefore the first part of the narrow canal which the fœtus has to traverse. Hence, the pains taken by accoucheurs to study this osseous opening can readily be conceived.

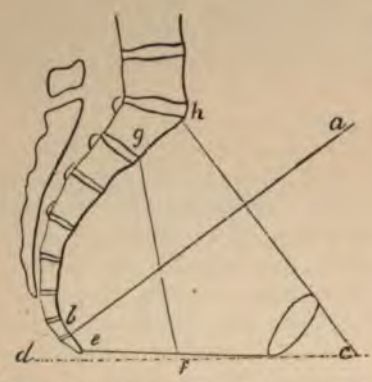
All the modern authors since the days of Deventer, have endeavored to fix precisely the degree of inclination of its plane and axis, to ascertain the direction the fœtus should follow in engaging in the pelvic canal, and to determine carefully the dimensions of the latter, and their accordance with those of the body, which is to pass through it.

The plane of the superior strait is inclined obliquely from above downwards, and from behind forwards; but writers are far from being unanimous in regard to the degree of its inclination; that is, in determining the angle formed by the sacro-pubic line, at the point where it meets a horizontal one, drawn from the superior part of the symphysis pubis towards one of the points on the anterior face of the sacrum. Although originally placed at 45° by J. J. Müller (1745), this angle has successively been fixed at 35° by Levret; at 75° by Camper, and at 55° by Saxtorph; and still more recently, Professor Nægèle, after a great number of researches, has concluded to consider it as an angle of 60° (1819). It is now generally admitted that the degree of inclination in the plane of the superior strait is from 55° to 60° in the erect position of the female.

The direction of the plane being once understood, it is an easy matter to ascertain that of its axis; for the latter being a line which falls perpendicularly upon the centre of this plane, it must evidently form with the vertical the same angle that the plane itself does with the horizontal line,

and consequently must have just the same degree of inclination. Being thus understood, the axis of the superior strait is a line (*a b*, Fig. 12) which, commencing near the umbilicus of the female, would pass directly through the centre of this strait, and fall upon the point of union of the upper two-thirds of the coccyx, with its inferior third. Hence, it will be directed from above downwards, and from before backwards. Further, the inclination of this plane varies according to the woman's position. Thus, it is almost nothing when recumbent, and sometimes in this position the plane of the superior strait instead of being directed forwards and upwards, even looks upwards and backwards (Dubois); when the trunk is bent strongly forwards, the inclination of the plane is diminished and becomes more nearly horizontal; towards the end of gestation, on the contrary, the inclination increases, especially when, in order to restore equilibrium, the upper part of the body is carried much backwards.

Fig. 11.



c h. The plane of the superior strait prolonged beyond the pubis. *c e*. The plane of the inferior strait prolonged beyond the pubis. *c d*. Shows the departure of this plane from the horizontal line. *a b*. The axis of the superior strait. *g f*. The axis of the inferior strait.

As the figure which represents the circumference of the superior strait is not a perfect circle, its dimensions, taken at different points, are, of course, unequal, and, accordingly, writers have admitted several diameters for it, thus:

There are three principal ones (Fig. 2), namely, an antero-posterior or sacro-pubic diameter *a a*, which extends from the sacro-vertebral angle to the upper part of the symphysis pubis; it is from four and a quarter to four and a half inches in length. 2. A transverse one, *b b*, passing from the middle of the rounded border that terminates the iliac fossa of one side, to the same point on the opposite side; this is five and a quarter inches long. 3. An oblique diameter, *c c*, extending from the anterior part of the sacro-iliac symphysis to the ilio-pectineal eminence of the opposite side; this is found on both sides, and is four and three-quarters inches long.

Fig. 12.

a a. The antero-posterior, or sacro-pubic diameter. *b b*. The transverse diameter. *c c*. The two oblique diameters. *s c*. The sacro-cotyloid interval.

Lastly, M. Velpeau admits a fourth diameter, called by him the sacro-cotyloidean; before described, however, by Burns, under the more exact name of

the sacro-cotyloid interval *a c*, existing between the promontory and the posterior part of the cotyloid cavity. This interval, according to the examinations of the French surgeon, is from four to four and one-eighth inches in extent; but from the results of Nægèle and Stoltz's researches it is much less, being scarcely three and a half inches (the mean obtained from ninety pelves). The circumference of this strait varies from thirteen to seventeen inches; Levret taught, that it equalled one-fourth of the female's height; but to establish such an approximation, the development of the pelvis should always be in direct proportion to the stature of the individual, which is certainly not the fact.

§ 4. Of the Inferior Strait.

The *inferior strait* — the *perineal strait* — or *apex of the pelvis* (as it is variously called), is more irregular in shape than the superior one. Its outline presents, in fact, three tuberosities or osseous projections, separated by as many deep notches.

If, however, the advice of Chaussier be followed, and a sheet of paper be placed over this opening, so as to trace its outline with a crayon, it will be found to have an oval figure, the smaller extremity of which is in front, and the larger one, looking backwards, is broken in upon by the prominence of the coccyx. This point, disappearing at the moment of the head's passage, offers no obstacle to the delivery; and, therefore, the strait may be considered as nearly an oval.

The periphery of the pelvis at its apex is formed by the inferior part of the symphysis pubis, the descending branch of this bone, the ascending branch and tuberosity of the ischium, the inferior margin of the great sacro-sciatic ligament, and by the border and point of the coccyx. Hence, three triangular projections are found in it: the two ischia upon the sides, and the coccyx behind. The first two are immovable, but the last, on the contrary, is effaced at the period of delivery, as just mentioned; for the mobility of the sacro-coccygeal articulation allows the coccyx to be pushed downwards and backwards by the fœtal head, as it traverses the inferior strait. The two lateral prominences, made by the tuberosities of the ischia, are placed on a plane somewhat lower than the point of the coccyx; and consequently, in the sitting posture, the weight of the body rests solely on those tuberosities, and not at all upon the coccygeal extremity. This circumstance furnishes us a reason why transverse contractions of the pelvis are far more frequent at the inferior strait than the antero-posterior ones.

The three notches also require a passing notice; thus, the two postero-lateral ones are very deep, but when the sciatic ligaments have been preserved, they are comparatively superficial; the third is found anteriorly; its apex corresponds to the inferior part of the symphysis pubis, its base to a line drawn between the anterior parts of the tuberosities of the ischia, and its sides are formed by the ischio-pubal *rami*. The term *arch of the pubis* has been applied to this notch. The columns of the arch are distorted outwardly, as if a rounded body had been forcibly expelled from the pelvis, whilst the bones were soft, and had pushed them before it; and this arrange-

ment, which is more marked in the female than the male, favors the descent of the head. The arch is three and a half to three and three-quarter inches broad at the base; but only one and a quarter to one and a half inches at its apex; in height, it is about two, to two and a half inches. Hence the area of the inferior strait will not present a uniform plane (should it be desirable to ascertain the irregularities it exhibits), because all parts of its margin are not upon the same level. However, to obviate the difficulty met with, in determining the direction of this plane, Dugès has divided the strait into two nearly equal portions, the one anterior, and the other posterior, meeting at the tuberosities of the ischium, and each presenting a distinct plane and axis; but as this method of proceeding uselessly complicates the question, we prefer considering the terminal plane of the pelvis, as represented by the coccy-pubal line, thus leaving out the lateral projections altogether.

The question is then reduced to these terms: What is the direction of the line that extends from the point of the coccyx to the inferior part of the symphysis pubis?

Writers, likewise, variously describe this; for instance, according to the majority of the French accoucheurs, the plane of the inferior strait is slightly oblique, from below upwards, and from behind forwards, so that it would unite with that of the superior strait (if prolonged) in front of the symphysis pubis. On the other hand, M. Nægèle concludes, from his numerous researches, that the inclination of the antero-posterior diameter of this strait is from 10° to 11° from the horizon, and that the point of the coccyx is found, as a mean, from a half to three-quarters of an inch higher than the summit of the pubic arch; and, therefore, the coccy-pubal line is a little oblique from above downwards, and from behind forwards. The lower extremity of the axis of this plane of the inferior strait would cut the coccy-pubic diameter at right angles, and terminate above at the sacro-vertebral angle. As a further result of his labors, he has found that, in five hundred well-formed persons, of different statures, four hundred and fifty-four have the point of the coccyx more elevated than the inferior portion of the symphysis; in twenty-six it was lower, and in twenty individuals both points were on the same level. M. Velpeau remarks, as we think with some reason, that, at the moment of delivery, — the only time, after all, when it is requisite to form an idea of the direction of this plane, — the point of the coccyx, being pushed downwards and backwards by the passage of the head, is at least on a level with, if not lower than the inferior part of the symphysis.

FIG. 13.

c d. The horizontal line. *c e.* The plane of the inferior strait (during labor). *a b.* The axis of the inferior strait.

The assertion of M. Nægèle, there-

fore, although true as applied to the female not in labor, fails during parturition; and it must be admitted that the plane of the inferior strait is then oblique from below upwards, and from behind forwards.

The axis of this strait is represented by a line (*a b*, Fig. 13) directed from above downwards, and from behind forwards, which, starting from the first piece of the sacrum, falls at a right angle upon the middle of the bis-ischiatic space. The remarks made upon the variations in the direction of the plane, apply with equal force to its axis. The latter crosses the axis of the superior strait in the excavation, forming with it an obtuse angle, the sine of which is in front.

It is also very important to know the dimensions of the perineal strait, and hence obstetricians describe three principal diameters at that point, namely—1. The antero-posterior or coccy-pubal diameter (*a a*, Fig. 14), running from the point of the coccyx to the summit of the pubic arch; it is usually four and a quarter inches long, but may increase to four and three-quarter inches during labor, by the retrocession of the coccyx. 2. The bis-ischiatic, or transverse diameter, *b b*, is four and a quarter inches in length, and goes from one tuberosity of the ischium to the other. 3. The oblique diameter, *c c*, commences at the middle of the great sacro-sciatic ligament, and crosses to the point of union of the ascending branch of the ischium, with the descending ramus of the pubis, and is four and a quarter inches long, but may become one-quarter of an inch more during labor, from the elasticity of these ligaments.

Fig. 14.

a a. The antero-posterior or coccy-pubal diameter. *b b*. The transverse or bis-ischiatic diameter. *c c*. The two oblique diameters.

All the diameters of the inferior strait are, therefore, in the dried pelvis, about four and a quarter inches in length, though their dimensions are susceptible of great variation during labor.

§ 5. Of the Excavation.

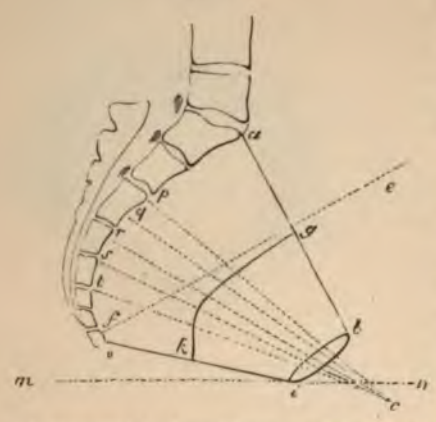
The excavation is that space comprised between the superior and the inferior straits, and it is in this cavity that the fœtal head executes its principal movements; and it is somewhat surprising, that, until quite recently, this canal was scarcely mentioned in the majority of the classic works, notwithstanding the importance of a knowledge of its dimensions, as also of the direction of its plane and axis.

Its dimensions comprise both the height and width at the different points: thus the height in front, is one and a half inches; upon the sides, three and three-quarter inches; whilst it is four and a quarter inches behind, if a straight line be drawn from the sacro-vertebral angle to the point of the coccyx, and five inches and a quarter, following the curve of the sacrum.

Three diameters are also described for this cavity (like the straits), so as to appreciate its extent in the different directions. All of them are taken at the centre of the excavation, and they consist of an antero-posterior one, of four and three-quarters to five and one-eighth inches in length, a transverse diameter four and three-quarter inches long, and an oblique one, of the same length; consequently, all the diameters of this cavity are very nearly four and three-quarter inches each.

If the canal forming the excavation were a cylinder, it would only be necessary to divide it by a plane, perpendicular to its walls, in order to represent the opening of this cavity; but a simple division, thus made, would not give a just conception of the excavation, for two reasons. First, the canal is not cylindrical, because its sides are not parallel, and the anterior face of the sacrum presents a well-marked curvature; the pubic wall being nearly straight, and the lateral parietes very oblique from without inwards, and from above downwards. Consequently, to furnish an exact idea of the general arrangement of the pelvic excavation, it seems necessary to divide the canal (see Fig. 15) by a series of planes, all passing from the point *c* (the point of intersection of the planes of the superior and inferior straits) to any point whatever, *p q r s t*, on the anterior face of the sacrum. Each of these planes will show the opening of the pelvic cavity at the level where it is found. Now, to determine, with certainty, the direction of the general axis of this excavation, it is requisite to raise a perpendicular line from the geometrical centre of each of these sections, and to draw a line *g k* through the base of each.

Fig. 15.



a b. The plane of the superior strait. *i d*. The plane of the inferior strait. *c*. The point where these two planes would meet, if prolonged. *m n*. The horizontal line. *e f*. The axis of the superior strait. *g k*. The axis of the excavation. *p q r s t*. Various points taken on the sacrum to show the plane of the excavation at each point.

This line *g k* (which, as the student will observe, is not straight) is called the general axis of the pelvis.

It is now readily understood that this line is nearly parallel to the anterior face of the sacrum, and its extremities correspond with the axes of the superior and the inferior straits; hence, this curve exactly represents the whole axis of the pelvis, or, in other words, the line which the fœtus must follow in traversing the pelvic excavation.

It would be wrong to consider the line, representing the entire axis of the excavation, as a simple curve; for M. Nægèle has well observed, that it cannot be composed of two straight lines, as often taught, nor is it a simple arc of a circle. In fact, the anterior face of the bodies of the first two bones

of the sacrum forms a straight line; the sacral curve embracing only the last three bones. Consequently, the central line, which is evidently parallel to this, will consist of a straight and a curved portion—straight, for that part of the excavation corresponding to the two superior vertebræ, and curved in the space, which is bounded behind by the last three sacral vertebræ, and in front by the anterior pelvic walls.

§ 6. Base of the Pelvis.

The base of the cone, represented by the pelvis, has its circumference directed upwards and in front; it exhibits, behind, a notch, into the bottom of which the base of the sacrum projects, and which is further filled up by the last lumbar vertebræ (generally left *in situ* to complete the posterior wall of the greater pelvis), by the ilio-lumbar ligaments, and by the quadratus lumborum muscles; 2, outwardly, the anterior two-thirds of the iliac crest furnishing attachments to the external and the internal oblique and transversalis abdominis muscles; and 3, in front, the anterior superior and inferior spinous processes of the ilium, the groove for the passage of the conjoint muscles—the psoas magnus and iliacus internus, the ilio-pectineal eminence, the superior border of the horizontal branch of the pubis, the spine, and lastly, the upper margin of the symphysis of this bone.

§ 7. Differences of the Pelvis.

1. According to the *sex*. Considered as a whole, the pelvis in the male is smaller but deeper, the bones are thicker, and the muscular impressions more marked, than in the female. The superior strait being more retracted, resembles the figure of a heart on a playing-card. The excavation is not so wide, though it is deeper, especially in front, owing to the greater length of the symphysis pubis; the arch of the pubis is straight, nearly triangular in shape, and is not widened in front. The coccyx is early joined to the sacrum, and the articulations of the pelvis are much sooner anchylosed than in the female. In the latter, we may add, that the iliac fossæ are larger and more warped outwardly (whence the prominence of the haunch bones), and the iliac crest less twisted in the form of an italic *f;* the interval separating the angle of the pubis from the cotyloid cavity is more considerable, causing, in part, the projection of the great trochanters, and a wider separation of the femurs; the superior strait is larger and more elliptical; the curve of the sacrum deeper and more regular; the tuberosities of the ischium are farther apart; the pubic symphysis shorter; the foramen thyroideum more triangular; the arch of the pubis broader, more rounded, and more curved, and the lateral borders, formed by the ischio-pubic ramus, more contorted outwardly.

2. According to the *age*. At birth, the pelvis is extremely narrow and elongated, and of such inconsiderable dimensions, that its cavity will not contain several of the organs afterwards found in it; from which circumstance, the protuberance of the belly, observed in the fœtus and in children at term, in great measure results; the excavation has the form of a cone, the abdominal strait being strongly inclined downwards; the sacrum is

front than behind), the termination of the two anterior and posterior vertebral ligaments, the interspinous ligament, and lastly, the *sacro-vertebral ligament*, a short, very strong, fibrous bundle, which descends obliquely from the anterior inferior part of the transverse process of the last vertebra, downwards and outwards, towards the base of the sacrum, where it is inserted.

Further, a synovial membrane is found in the articulation between the oblique process of the sacrum and those of the vertebræ.

To these must also be added the ilio-lumbar ligament, which passes from the apex of the transverse process of the fifth lumbar vertebra to the thickest portion of the iliac crest; and the ilio-vertebral ligament formed of two fibrous bands, the superior of which arises from the middle and lateral part of the body of the last lumbar vertebra, and the inferior, from the inter-sacro-vertebral space; both are then spread out on the coxal bone.

§ 5. Obturator Membrane.

The obturator membrane still claims a description, in order to finish the history of the ligamentous apparatus of the pelvis. This, as has been remarked by M. Cruveilhier, like the sacro-sciatic ligaments already spoken of, is rather an aponeurosis serving to complete the pelvic walls, than a true ligament.

These resisting membranes are probably intended to diminish, in the hour of labor, the compression of the mother's soft parts, included between the infant's head and the osseous parietes of the pelvis, as also to favor, by their elasticity, the passage of the head through the pelvic excavation.

Obturator membrane.—This membrane subtends the foramen thyroideum, excepting at its superior part, where an opening exists, which converts the groove, intended for the passage of the obturator vessels and nerves, into a complete canal. Being inserted by its external semi-circumference into the corresponding part of the periphery of the obturator foramen, it is attached by its internal half to the posterior face of the ascending ramus of the ischium. Its surfaces afford origins for the two obturator muscles. This membrane is composed of aponeurotic fasciculi, which cross each other in every direction. (*Cruveilhier.*)

ARTICLE III.

OF THE PELVIS IN GENERAL.

Studied in its general aspect, the pelvis represents a cone, slightly flattened from before backwards; the base of which, being above, is at the same time inclined forwards, whilst the apex is directed downwards and a little backwards.

§ 1. External Surface of the Pelvis.

Anatomists have divided this surface into four regions: the anterior of which exhibits, on the median line, the front part of the symphysis pubis.

which is directed from above downwards and from before backwards, at an angle with the perpendicular of some 15° to 20°; next (passing outwards) is a smooth surface, from which several muscles of the thigh arise, then the external obturator fossa, occupied in the recent subject by the muscle of the same name, and finally by the anterior half of the edge of the cotyloid cavity.

The posterior, bounded by the hinder part of the iliac crest, presents, on the median line, the ridge of the sacral spinous processes, the inferior opening of the vertebral canal, the union of the sacrum with the coccyx, and the posterior face of this latter bone.

The ten posterior sacral foramina, transmitting the nerves of the same name, are found in two deep gutters, on the sides. These grooves prolong the spinal gutters, and are occupied in the recent state by the commencement of the sacro-spinal muscles. The lateral regions may each be divided into two parts: one, the superior, is the external iliac fossa; the other, or inferior, offers, behind, the posterior aspect of the sacro-sciatic ligaments, and the plane of the notches or foramina bearing the same name; and, in front, the cotyloid cavity and the external face of the tuberosity of the ischium.

§ 2. Internal Surface.

The internal surface or cavity of the pelvis has been aptly compared to the basin of the ancient barbers. (*Vesalius.*) In fact, like those vessels, it has a superior part which spreads out freely, and is called the *great*, the *superior*, or the *abdominal* pelvis; and an inferior one, more contracted, bearing the title of the *little pelvis*, or *pelvic excavation.*

1. The *great pelvis* has a very irregular figure, and forms a species of pavilion to the entrance of the pelvis. Its walls are three in number: the anterior one is deficient in the dried skeleton, but in the living state it is supplied by the anterior abdominal muscles; its posterior parietes exhibit a notch in its middle, that is ordinarily filled up by the projection of the last lumbar vertebræ, which are usually left in connection with the pelvis, although in reality not forming any part of it. Two gutters are found on the sides of this eminence, occupied by the psoæ muscles; further outwards, the anterior part of the sacro-iliac symphyses appear, which constitute the boundaries between the posterior and lateral regions: these latter are constituted by the internal iliac fossæ, covered by the iliacus internus muscles.

2. The *lesser pelvis*, or *basin*. This forms a curved canal, larger in the middle than at its extremities, and slightly bent forward. If all the parts described as appertaining to the great pelvis be removed by the saw, as recommended by Chaussier, a species of ring will remain, whose circumference, being narrow in front and much broader behind, will furnish a correct idea of the shape of the pelvis. Four regions are found in this cavity also:

The *anterior* one is concave transversely, and is inclined upwards, having the posterior part of the pubic articulation near its middle: this is generally prominent, assuming the form of a longitudinal pad, which may in some cases project to the extent of from two to three-eighths of an inch. Towards

ments of rotation, executed by the head in the pelvis, to the action of these muscles; but the same reasons that caused us to reject the influence of the inclined planes on this process, equally deter us from entertaining the opinion of the Strasburg Professor. The pelvic cavity is still further diminished by the rectum, bladder, and cellular tissue; more especially when the latter is loaded with fat. Consequently, the fœtal head descends with more difficulty in very corpulent women than in others.

The perineal strait, although open in the dried skeleton, is here occupied by a sort of contractile concave partition, which sustains the viscera of the pelvic and abdominal cavities. This floor, so to speak, is composed of two muscular planes; the interior of which, formed by the levator ani and coccygeal muscles, is concave above; and the other, having its concavity below, is constituted by the sphincter ani, the transversus perinei, the ischio-cavernous, and the constrictor vaginæ muscles. The internal pudic vessels and nerves, a large amount of cellular tissue, the skin, the pelvic aponeurosis, and an inter-muscular aponeurosis complete this floor, which, in the hour of labor, ought to become thin and distended, but which occasionally offers such an obstacle to the spontaneous delivery of the fœtus as to require the intervention of art.

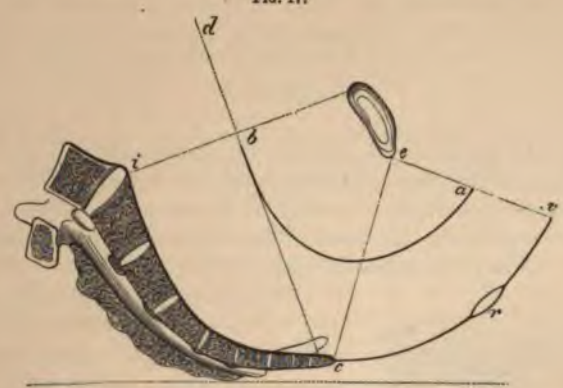
The extent of the perineum, in its ordinary condition, is three inches, namely: from the point of the coccyx to the anus, there are one and three-quarter inches, and from the anus to the vulva, one and one-quarter inches; but at the instant of the passage of the head through the genital fissure it becomes so distended, that the interval separating the anterior commissure from the coccyx, is increased from four to four and three-quarter inches.

It must now be evident that the terminal outlet of the pelvic canal, in the pelvis, covered with its soft parts, is not at the point of the coccyx, but rather at the anterior commissure of the perineum; in fact, the latter is so greatly distended in the last moments of labor, that its anterior border goes beyond the inferior part of the symphysis pubis, thereby prolonging very considerably the posterior wall of the pelvic excavation, and, as a consequence, the canal to be traversed by the fœtus. Wherefore, the direction in which the head is ultimately disengaged is not represented by the axis of the inferior strait, but by that of a plane which may be drawn from the lower part of the symphysis to the anterior commissure of the distended perineum.

Hence, in order to form an exact idea of the line traversed by the fœtus, from its entrance into the superior strait until its final exit from the vulva, it will be necessary to continue the operation already pursued upon the anterior face of the sacrum (see page 52) over the curve represented by the anterior face of the distended perineum: that is, to make a series of planes from the point *c* (Fig. 15) to the divers parts of the perineal curve; and, from the centre of each, raise a perpendicular, so as to form by their union a complete axis, the upper extremity of which is the axis of the superior strait; the middle part, a curved line, having its concavity anterior and its convexity parallel to the front face of the sacrum and perineum, and the inferior extremity directed from before backwards, and slightly from above downwards.

It must not, however, be forgotten, that the direction just described belongs to the vertical posture, and that it becomes remarkably altered in the various attitudes assumed by the female. Thus, whilst lying upon the back, as is usual in France during labor, the plane of the superior strait instead of looking upward and forward will be turned upward and backward, and its axis directed from above downward and from behind forward. At the same time, the plane of the inferior strait, which before looked backward and downward, will be turned almost directly forward, its axis also passing directly from before backward. Finally, the terminal orifice formed by the contour of the vulva presents another plane, which at the moment of delivery (the horizontal position being still maintained) is directed upward and forward. In short, the central line followed by the fœtus during

Fig. 17.



Position of the pelvis and the direction of its axis in the dorsal attitude assumed by the female during labor.

a b. Total axis of the excavation, being a continuation of *d b*, the axis of the superior strait. *c v*. Perineum as distended at the moment of the passage of the head. *r*. Anal orifice. *e v*. Terminal plane of the pelvis.

its expulsion is a strongly-marked curve, whose concavity is turned almost directly upward (Fig. 17).

CHAPTER II.

OF THE EXTERNAL ORGANS OF GENERATION.

The genital apparatus of the female is much more complicated than that of the male, and is composed of organs situated in the interior of the pelvis, and of parts attached to its exterior. The former are the ovaries, Fallopian tubes, uterus, and vagina, and the latter, the mons veneris, vulva, and perineum. We commence by describing the external organs of generation.

ARTICLE I.

MONS VENERIS.

The *mons veneris* is a rounded eminence, a species of *relief*, more or less prominent according to the embonpoint of the individual, situated in front of the pubis, and surmounting the vulva; this eminence is partly produced by the bones, and partly by the subcutaneous adipose tissue; the skin covering it is very thick and elastic, but being little extensible, it cannot aid in the enlargement of the vulva, as asserted by M. Moreau, at the period of delivery. In the adult female, it is covered with hair, and contains a great number of sebaceous follicles.

ARTICLE II.

VULVA.

The *vulva* is a longitudinal opening or fissure, situated on the median line at the base of the trunk; being bounded in front by the mons veneris, behind by the perineum, and laterally by the external labia.

We shall comprise in its description, as properly appertaining thereto, all the parts included between the labia majora.

Fig. 18. External genital parts.

1. Labia majora. 2. Fourchette. 4. Clitoris. 5. Orifice of urethra. 8. Hymen.

1. The *labia majora*, or labia externa, are two cutaneous folds, flattened transversely, and thicker in front than behind, which bound the opening of the vulva externally; commencing at the mons veneris, they gradually recede from each other, as they pass backwards, nearly to their middle, where they again approach, so as to unite at the posterior extremity, and form there a bridle or commissure called the *fourchette*, which is generally lacerated during the first labor.

The labia externa present an external or cutaneous surface, which is covered with hair after puberty; and an internal one, moist, smooth, of a rose color, and formed by a mucous membrane that is provided with a considerable quantity of sebaceous glands and papillæ.

In young girls, the external lips are somewhat thicker above, and approach each other closely; but in females who have borne children they are separated, and have lost their regularity.

They consist of a cutaneous and a mucous layer, between which is a fibrous partition, a continuation of the superficial fascia of the perineum. Between this aponeurosis and the internal surface of the integument, is found a very thick layer of cellulo-adipose tissue, filling up a peculiar pouch hitherto unknown to anatomists until discovered by M. Broca.

[This pouch is constituted by a membranous sac situated between the skin and the superficial aponeurosis: its bottom is directed towards the fourchette, where it becomes blended with the fascia superficialis of the parts on each side of the anus. It has a long and narrow neck, which is directed toward the external inguinal ring, and receives into its opening a portion of the fibres of the round ligament. Its cavity is filled with cellulo-adipose tissue, varying in quantity with the embonpoint of the individual. The pouch forms of itself the greater part of the thickness of the labia majora.

The fibres of which the pouch is composed are derived chiefly from the fascia superficialis of the thigh and abdomen, but some proceed directly from the spine of the pubis; the most external are attached to the rami of the pubes and ischia, whilst the most internal unite and become blended with the suspensory ligament of the clitoris.

According to M. Broca, this sac is the analogue of the dartos of the male; M. Sappey, however, believes that it is comparable only to the suspensory ligament of the scrotum and penis. The microscope proves it to be composed of interlaced fibres of elastic tissue.

The arteries of the labia majora are derived from the perineal artery, itself a branch of the internal pudic or of the external pudic or epigastric.

The veins for the most part accompany the arteries, some, however, pass backward and form a plexus, which communicates with the bulb and vaginal veins. These veins, which are very numerous, often become dilated during pregnancy.

The nerves proceed from the genito-crural branch of the lumbar plexus, and from the perineal branch of the internal pudic nerve. The lymphatics all pass into the inguinal glands.]

2. The *nymphæ*, or *labia interna*, are brought into view, by separating the external lips, under the form of two mucous folds, resembling the comb of a young cock. Contracted behind, where they are continuous with the internal face of the labia externa, they spread out in front as they converge towards each other. These lips scarcely descend to the middle of the external ones, but they mount up in front as high as the clitoris, where they bifurcate; the inferior branch of this bifurcation is lost in the clitoris; but the other surmounts it, joins its fellow of the opposite side, and forms above this body a little fold in the shape of a hood, called the *prepuce of the clitoris*. At birth, the nymphæ project beyond the external lips, but at puberty they are concealed by the latter. Again, they become visible in child-bearing women; rather, however, by the separation of the labia majora than by their own prominence.

Further, their dimensions are very variable in different individuals, and in various climates; thus, in certain countries of Africa, they are very long, and constitute the famous *apron* of the Hottentots. Besides, as Velpeau has remarked, these parts are so extensible that, under the influence of continual tractions, they may become very much elongated. I have met with a young female in my own practice, who was afflicted with an ex-

cessive itching at the vulva at the commencement of her pregnancy. To relieve this, she was in the habit of scratching continually, and in her impatience dragged on the right nympha, so that, in less than a fortnight, it had become twice as long as its fellow.

[The internal labia are covered with tesselated epithelium, below which are papillæ whose sensibility is especially exercised during copulation. The papillæ of the internal surface have a greater development than those of the external surface, and their size is found to increase as they approach the orifice of the vagina.

The blood-vessels of the internal labia are supplied by those of the labia majora. A portion of the veins anastomose largely with those of the bulb and of the vagina.

The nerves come from the perineal branch. The lymphatics proceed to the inguinal glands.]

3. *The Clitoris.*—Under this name, a little erectile tubercle, resembling the corpus cavernosum of the male (except in volume), is described. Its free extremity appears at the front part of the vulva, about half an inch behind the anterior commissure of the labia externa, and its body is attached by two crura to ischio-pubic rami; these roots ascend, converging and increasing in size, to the level of the symphysis, where they unite to form a single cavernous body, flattened on its sides, which after a course of two or three lines in front of the symphysis, becomes detached and curved forward so as to present a convexity above and in front, at the same time growing more and more slender towards the free extremity, which is called the *glans clitoridis.*

During the first months of the intra-uterine life it is difficult to make out the distinction of the sexes, because the clitoris is as long as the penis; even in the earlier years of existence its dimensions are quite considerable, but after this period it ceases to grow, and, in some females, apparently diminishes. Again, in certain rare cases, it acquires a great length; for instance, M. Cruveilhier has seen one whose free extremity measured two inches, and a case is on record where it reached from four and a quarter to five inches. Most of the pretended hermaphrodites may be referred to anomalies of this kind.

Henle gives a representation of a case so singular and rare as to deserve mention. It is a congenital division of the clitoris occurring in a girl of seventeen years of age, in which the body of that organ was completely divided through the middle so as to form two nipples, each invested with a prepuce. The halves of the prepuce thus divided, are prolonged respectively toward the corresponding nympha, from which it is separated by a notch, and is lost, above, in the frenum clitoridis.

The clitoris, like the penis, has a suspensory ligament, and an erector muscle; the canal of the urethra in the female passes between the two branches of the cavernous body, as it does in the male.

[The structure of the clitoris is, in all respects, precisely that of the corpus cavernosum of the male, except in point of size. It presents the fibrous envelope, the muscular trabeculæ, and the helicine arteries, all characteristic of the erectile

tissue. During coition, blood accumulates in it, dilates it, and thereby causes its erection.

The arteries of the clitoris come from the perineal artery, and are distributed as in the male, presenting therefore the cavernous artery, which on each side enters the corresponding corpus cavernosum, and the dorsal artery, which is distributed to the mucous membrane known as the prepuce of the clitoris.

The veins form a plexus arranged in two planes, the most superficial of which furnishes the dorsal vein, whilst the deeper communicates with the veins of the bulb, of the vagina, and of the bladder.

The nerves proceed from the perineal branch of the internal pudic; they send branches to the corpus cavernosum, and terminate in the prepuce, which is the principal seat of voluptuousness in the female.]

4. The *vestibule* is a small triangular space placed at the upper part of the vulva. It is bounded above by the clitoris, below by the urethra, and laterally by the nymphæ.

5. *The Urethra.* — The meatus urinarius is situated just below the vestibule, about an inch from the clitoris, and immediately above the prominent enlargement of the anterior part of the vagina. The orifice is usually more contracted than the canal, but the tubercle or enlargement just alluded to, enables us to sound females without uncovering them, for it is only necessary to recognize it by the finger in order to direct the instrument properly. In my estimation, the following is the most simple method of introducing the catheter without uncovering the patient; I first introduce my finger into the orifice of the vagina, and rest its palmar face against the anterior vaginal wall; I then slide the instrument along this palmar face until it is arrested by the fold already alluded to; then I depress the extremity so as to elevate the point of the instrument one or two lines, and in the majority of cases, the canal is easily entered in this manner.

[If the first attempt should fail, it may be tried again in another way. The point of the forefinger finds the clitoris, and passes from above downwards to the middle of the vestibule; the first inequality met with is the orifice of the urethra, into which the instrument can then be inserted. I have often succeeded in this way, after having failed by the ordinary method.

In some women, those especially who have borne children, the parts adjoining the meatus are so deformed, that it becomes absolutely necessary to expose the parts in order to introduce the catheter; even then it is by no means easily done, and I have seen the most skilful foiled in attempting it. It may be accomplished with certainty by separating carefully the greater and lesser labia, and then sliding the extremity of the catheter from above downward along the median line of the vestibule below the clitoris, which is the chief rallying point. During this movement the instrument falls, so to speak, of its own accord into the orifice of the urethra; but if slid either to the right or left, it will be sure to go astray. We shall learn hereafter (article *Pregnancy*) the cause of the difficulties met with in catheterizing pregnant women.]

The urethra, a continuation of the meatus urinarius, just described, varies in the female from one to one and a half inches in length. It is large, conical, and slightly curved. Its inferior portion is confounded

with, or at least intimately united to, the anterior vaginal wall, and its anterior parietes, separated in front from the pubis by some cellular tissue only, is located on a level with the symphysis, under the junction of the two crura of the clitoris.

The canal of the urethra is muscular and erectile, having a thick lamina of muscular fibres, which seem to be a continuation of those of the bladder; another thick layer formed by a venous plexus, lies subjacent to the mucous membrane.

Occasionally, this canal is enormously dilated. Flamand met with a case that permitted the introduction of the finger, and Meyer, with another, which eventually admitted of coition!

6. *The Hymen.*—The irregular opening of the vagina is found beneath the meatus urinarius; it is of variable dimensions after coition, and in females who have had children; but in virgins, it is provided with a membrane by which the orifice is diminished. This membrane is the *hymen*, a species of diaphragm, interposed between the internal organs and the external genital apparatus and the urinary passages. It resembles a crescent in shape (Fig. 19), the concavity being anterior; sometimes the horns of the crescent are prolonged enough to join each other, thus forming a complete circle, perforated in the centre (Fig. 20); its free margin is thin and concave; the convex one is continuous with the membrane of the vagina or vulva, and as this blocks up the posterior and lateral parts of the vagina, a notable difference will exist in the extent of the orifice, dependent upon the greater or less size of the hymen.

Sometimes the hymen forms a complete imperforate membrane. Though often thin, transparent, and very fragile, it is occasionally found thick and resisting.

Fig. 19.

Fig. 20.

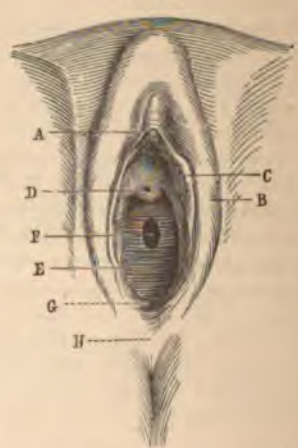


Fig. 19. Hymen in the form of a crescent.

A. Clitoris. B. Labia externa. C. Labia interna. D. Orifice of the urethra. E. Hymen. F. Orifice of the vagina. G. Posterior commissure of the vulva.

Fig. 20. This figure exhibits the hymen in the form of a circle. E. The hymen. F. The central opening somewhat elongated.

The two forms just mentioned are not the only ones which the hymen may assume; other varieties have been described by M. Velpeau, as follows: 1. In the semicircular species, the hymen may form such a narrow and solid fold as to permit copulation without being ruptured. 2. In the crescentic variety (Fig. 19) the concave border approaches more or less towards the urethra, in such a way as to contract the vagina behind, and hence it almost always gives way in coition. 3. In the circular variety, the free border is much thinner than the other (Fig. 20), often being fringed, as it were, and leaving an opening which is sometimes round, sometimes slightly elongated, though in general situated somewhat nearer to the anterior than the posterior wall of the vagina. 4. Again, we find a disk or complete diaphragm, that is ordinarily pierced by a number of small holes like those of a watering-pot, and at other times is without the least aperture. 5. In some instances a species of bridle, or a small cord attached under the urethra, or on the concave border of the hymen, supplants both the valve and the circle. 6. Lastly, a second hymen occasionally exists above the first.

This membrane is regarded as the seal of virginity; and yet, as just shown, it is often found after a fecundation; and, on the other hand, numerous causes besides coition may destroy it. It is generally ruptured at the first sexual approaches, and of its debris are formed two or three little tubercles, bearing the name of *carunculæ myrtiformes.*

Parturition generally destroys the posterior and inferior segments of the hymen, the *carunculæ myrtiformes* slough away, and only the small superior fringes remain. This condition serves as a generally reliable means of distinguishing between the vulva of a woman who has borne children and a nulliparæ, where the hymen is merely torn and can be restored to its virginal shape by approximating its edges. (See Plate xii.)

The hymen is composed of a fold of mucous membrane, containing between its laminæ a few vessels and some areolar tissue.

7. The *carunculæ myrtiformes* are some little tubercles, two to five in number, which appear to be the debris of the ruptured hymen; the two most anterior ones, according to certain physiologists, appertain to the median columns of the vagina.

In consequence of oft-repeated friction, these caruncles may inflame, degenerate, and even become the source of an abundant purulent discharge; they have been mistaken under such circumstances for syphilitic vegetations, and the patient subjected to anti-venereal treatment, which, at least, was useless. Personal cleanliness, and some of the vegeto-mineral lotions are usually sufficient to cause their disappearance. M. Velpeau has resorted, however, in some cases, to excision.

8. *Fossa Navicularis.*—This is a little depression, of half an inch only in extent, bounded behind by the fourchette, and in front by the convex border of the hymen. It, like the fourchette, formed, as before stated, by the junction of the inferior extremities of the labia majora, mostly disappears after delivery.

ARTICLE III.

OF THE SECRETORY APPARATUS OF THE EXTERNAL ORGANS OF GENERATION.

[The secretory apparatus of the female genital organs has been the subject of numerous investigations, but of late a fresh interest in the subject has given rise to works by Robert, Huguier, Sappey, Martin, and Léger, all of which are placed under contribution in the preparation of this article.

Aside from the piliferous bulbs, the glands of the vulva may be arranged in three classes: 1. Sudoriparous glands; 2. Sebaceous glands; 3. Muciparous glands and follicles.

First class. — The *sudoriparous glands* are found on the penil and the external surface of the labia majora; they are mingled with the sebaceous glands and surround the bases of the hair bulbs. Presenting the same arrangement as in other parts of the body, they are noticeable here on account of their great number.

Second class. — The *sebaceous glands* of the vulva are extremely numerous. Those of the mons veneris and of the outer surface of the labia majora are remarkable for their size, having an average diameter of $\frac{4}{100}$ of an inch. They are generally composed of from four to six lobules, each containing eight or ten *culs-de-sac*. They always open upon a piliferous bulb.

The internal surfaces of the labia majora are also provided with sebaceous glands to the extent of about forty to every $\frac{2}{3}$ of an inch square. They are still more numerous upon both sides of the lesser labia, the inner surfaces of which present about one hundred and fifty to every $\frac{2}{3}$ of an inch square. Martin and Léger note the fact, that these glands, which are very apparent in the adult female, become atrophied after the cessation of the menstrual function, and cannot be found at all in the fœtus.

The sebaceous glands are also found on the fourchette and the prepuce of the clitoris. No trace of them, however, is to be discovered either in the vestibule or around the orifice of the urethra.

These glands secrete an oily matter, which maintains the suppleness of the parts to which it is applied, prevents them from contracting abnormal adhesions, and preserves them from irritation by the urine.

Third class. — The muciparous follicles as described by M. Huguier, present two varieties: in the first, they are isolated or simply agminated, *isolated* or *agminated follicles;* in the second they are enclosed in one envelope, and discharge into the same excretory canal, *vulvo-vaginal glands.*

A. *Isolated* or *agminated muciparous follicles.* These follicles exist, according to Huguier, upon several points of the circumference of the vaginal orifice; they are sometimes absent and always difficult to discover; their existence even has been denied by some anatomists (Sappey, Martin, Léger). Huguier describes three groups of them.

1. — Eight or ten of them are found in the vestibule below the clitoris, where they open by separate orifices, which are very small and partly covered by a root of valve easily raised by a probe; (*Vestibular* follicles of Huguier) (fig. 21, A). These follicles are mere depressions in the mucous membrane without a diverticulum. So simple is their structure, that Martin and Léger refused to call them *muciparous follicles.*]

2. Others, termed *urethral follicles* on account of their situation, are stated by M. Huguier to be less readily discoverable than the preceding, on which account they were supposed by M. Robert to be less numerous. They are

of considerable size, and are situated at a depth of from three-eighths to four-eighths of an inch in the cellulo-vascular tissue of the urethra (Fig. 21, C). They are placed beneath the mucous membrane in a direction parallel to the canal, and discharge in close proximity to the orifice of the urethra upon the surface of the projection which forms the inferior boundary of that opening in such a way as to form a semicircle, or sometimes even an entire circle, around it. They are closer together than those which have been just described, and sometimes several of them open into the same excretory cavity, so as to produce the ramified arrangement which Graaf has figured and described.

Fig. 21.

3. Laterally, and at some distance from the urethral orifice, are several small and shallow ones, with a common opening at the bottom of a remarkable conical depression. M. Huguier states that these are often absent, and he proposes calling them the *lateral urethral follicles* (Fig. 21, B).

4. Besides these, some two, three, or four large follicles are found in some females upon the lateral parts of the vaginal orifice, immediately below the hymen or the upper carunculæ myrtiformes (Fig. 21, D); they are the *lateral follicles of the orifice of the vagina.* Their openings ordinarily correspond neither in number, situation, nor arrangement, with those of the opposite side; some are slightly projecting whilst others are not so, and some are readily visible whilst others are hidden beneath the myrtiform caruncles.

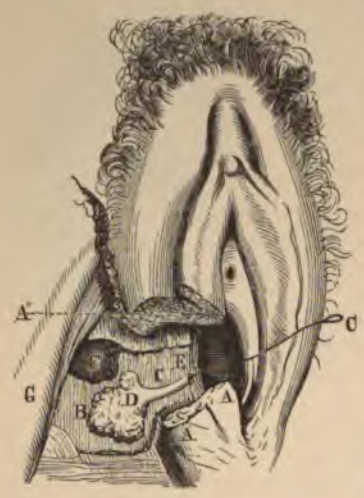
B. *Vulvo-vaginal gland.*—This gland had been completely lost sight of by modern anatomists, although described by Gaspar Bartholin; and attention has only recently been called to it by M. Huguier. It belongs to the class of conglomerate glands. There are two vulvo-vaginal glands, one on each side, where they form peculiar bodies whose position it is important to define with exactness. They are situated at the limits of the vulva and vagina, upon the lateral and posterior parts of the latter, about three-eighths of an inch above the upper surface of the hymen or of the myrtiform caruncles, in the triangular space formed on each side by the juxtaposition of the rectum and vagina, upon the latter of which they repose. They lie at a distance of from three-eighths to five-eighths of an inch from the internal surface of the ascending rami of the ischia, and from three-quarters of an inch to one and a quarter inches from the external labia.

The vulvo-vaginal gland has somewhat the shape of an apricot-kernel, resembling in this respect the lachrymal gland; like the latter, its two surfaces are flattened, and it is besides slightly lobular and mamelonated. According to M. Huguier, it is much flatter in women who have borne children, which he attributes to the species of separation which its granular elements must undergo from the enormous distention of the vulva during

labor. The gland of the right side does not always resemble that of the left, it is indeed not uncommon to find one much more developed than the other.

Its size varies much according to age, habits, and, adds M. Huguier, according to the development of the ovaries, which appear to exercise a decided influence over it; for he has always found the largest gland upon the same side with the most voluminous ovary. It also appears larger in females who indulge immoderately in sexual pleasures. Its size is greatest, in general, between the ages of sixteen and thirty-five years. Its diameter at this period of life is, on an average, from four-eighths to five-eighths of an inch. It is very small at puberty, and becomes atrophied in old age.

Fig. 22.



Vulvo-vaginal Gland.

A A. Section of the labia majora and of the nymphæ, showing the excretory duct and its orifice. B. The gland. C. Excretory duct. C'. Stylet engaged in the orifice of the excretory duct. D. Its glandular extremity. E. Its vulvar extremity and orifice. F. Bulb of the vagina. G. Ascending ramus of the ischium.

Excretory Duct.—Each of the granules of which the gland is composed is furnished with a minute duct, which, by uniting with those of the neighboring granules, gives rise to three separate ducts. The latter soon join to form a single canal, which proceeds from the internal surface and vulvar extremity of the gland (Fig. 22, D), and opens in virgins, or in females in whom the hymen has been only dilated, in the internal angle which the great circumference of this membrane forms by its union with the contour of the vulvar opening, and, when the hymen has been ruptured, at the base of the lateral and posterior myrtiform caruncles (Fig. 22, E). The orifice, which is smaller than the duct which it terminates, is in most women surrounded by a vascular area, which serves, by its lively red color, to distinguish it from the neighboring parts. If required, it will only be necessary to turn the caruncle inward in order to render it conspicuous. it should however be distinguished from three or four minute openings found in the same furrow, and which belong to the lateral follicles of the orifice of the vagina.

The direction of the opening of the duct is perpendicular, but its oblique orifice is directed upwards and inwards. Its external semi-circumference is provided with a small falciform, valvular fold of mucous membrane, which increases the difficulty of its detection. In the normal condition the diameter of the orifice hardly exceeds the one-one-hundreth of an inch.

The diameter of the duct varies from the one-twenty-fourth to the one-eighth of an inch, and its length, which lessens as the gland is more voluminous and approaches near the myrtiform caruncles, is, on an average, about five-eighths of an inch.

Uses and Functions.—The vulvo-vaginal gland, like the entire generative apparatus of which it forms a part, acquires its full development only at puberty. This concordance alone, independently of observation, would lead to the supposition that the fluid which it secretes is destined to bear a part in the generative act.

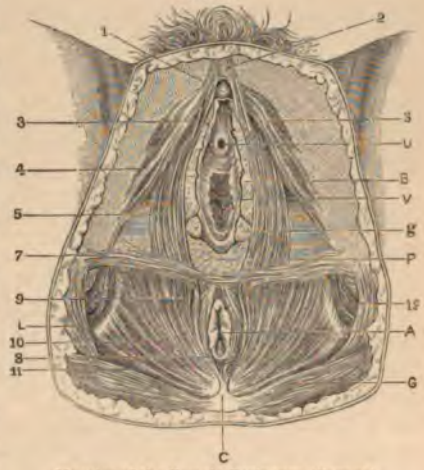
The amount of its secretion is, in fact, variable. It is especially increased during sexual intercourse, illicit contacts, and under the influence of lascivious thoughts, desires, and dreams. When, during coition, the muscles of the perineum and vulva are excited to involuntary and convulsive contractions, it is expelled in an intermittent manner or by jets, as is the sperm in the ejaculation of the male. According to M. Huguier, the use of this abundant secretion is to lubricate the external parts, and thus render the first approaches less painful, to maintain the humidity of the organs during the act, and thereby preserve their extreme sensibility.

ARTICLE IV.

PERINEUM — PERINEAL FLOOR — PERINEAL BODY.

The pelvic floor is formed by successive layers of fasciæ and muscles, which are pierced by the anus, vulva, and urethra. Beginning externally, it consists of the external cutaneous tissue, the sub-cutaneous cellular tissue, the sub-peritoneal tissue, and the peritoneum. The space between the vagina and rectum is occupied by a structure peculiar to the female, which is known as the *perineal body.* It is a point of attachment for a number of fasciæ, which, midway between the posterior vulvar commissure and the anus, are fused together with connective tissue and elastic fibres, forming an elastic and extensible structure, upon which the integrity of the parts depends in the last stage of labor.

Fig. 22*a*.



Muscles of the Female Perineum (Savage).

A. Anus. B. Bulb of vagina. C. Coccyx. L. Larger sacro-sciatic ligament. P. Perineal body. U. Urethra. V. Vagina. g. Vulvo-vaginal gland. 1. Clitoris. 2. Its suspensory ligament. 3. Crura clitoridis. 4. Erector clitoridis muscle. 5. Bulbo-cavernosus muscle. 7. Superficial transverse muscle. 8. Sphincter. 9. Pubo-coccygeus muscle. 10. Obturato-coccygeus. 11. Ischio-coccygeus. 12. Obturator externus.

The perineal body is triangular in shape. The apex extends a little above the middle of the vagina. The base of the triangle forms the inferior plane covered by the skin, separating the vulva from the anus, and is known as the *perineum.*

It is from an inch to an inch and a half long. During labor, the fœtal head, forced down by the uterine contractions upon the perineal body, dilates the vagina, compresses the rectum behind and the bladder in front, bulges the perineum, and stretches it from three to five inches.

CHAPTER III.

OF THE INTERNAL ORGANS OF GENERATION.

THE internal organs of generation are the vagina and the uterus, together with its appendages, the Fallopian tubes and ovaries.

ARTICLE I.

OF THE VAGINA.

The vagina, or vulvo-uterine canal, is a cylindrical membranous tube, extending from the vulva to the uterus; it is situated in the pelvic excavation between the bladder and rectum; extending from the vulva to the superior strait, it has of course the same direction as the general axis of the pelvis: that is, it forms a curve, the concavity of which is anterior; the walls are soft and yielding, flattened from before backwards, with their surfaces in contact. Its length varies from four and a quarter to five and a quarter inches, though, according to Professor Velpeau (*Leçons Orales*), it is much less than has been generally imagined, or than he himself has pointed out in his works, being hardly two and a quarter to two and three-quarter inches long. Although this remark may be true, if the length be measured in the dead subject, where the soft flabby walls of the vagina easily yield under their own weight and that of the uterus, and in consequence, the vertical extent of this cavity does not exceed three or three and a half inches; yet, the elasticity of these walls will permit the introduction of a speculum five or six inches long, and when the uterus is raised completely above the superior strait, the estimate of the Professor of La Charité is certainly below the truth.

The length of the vagina varies in different females; thus, for instance, the negress has it longer and more spacious than the European, as a general rule. Professor Chomel informed me that he had frequently remarked this fact, and I have since had occasion to verify its truth; nor is the vagina uniform in its size, in all parts of its extent; for the inferior orifice is the most contracted, the superior extremity is the largest, whilst the middle part, especially in women who have had many children, frequently exhibits a considerable extension. The walls apparently retract in aged females, and greatly diminish the area of its cavity, returning very nearly to the same dimensions as are found in young girls.

This canal is sometimes very short, reduced even to one and a half or two inches; but this congenital brevity must not be confounded with the apparent shortening produced by the descent of the uterus.

M. Cruveilhier says these cases are daily confounded in practice, though nothing, however, is easier than to distinguish them from each other; for, in the former one, the uterus cannot be raised, whereas, in the case of descent, it yields without resistance to the pressure of the finger, and resumes its natural position.

Congenital shortening is a frequent cause of sterility, as well as of sharp

pains in coition, and is a fruitful source of the acute or chronic inflammatory engorgements of the uterus. I have met with a case of considerable shortening of the vagina, in which the os tincæ had been sufficiently dilated by the *membrum virile*, to admit the index finger. In some instances the repeated coition produces a sort of artificial vagina, behind the os uteri, at the expense of the posterior vaginal wall, and if the finger be then carried under the neck of the womb, it will dip into a pocket, the anterior wall of which is placed against the posterior one of the uterus. This artificial vagina, produced by forcing up the posterior cul-de-sac, is sometimes longer than the natural canal.

The vagina is in relation by its external face: in front, with the bas-fond of the bladder, to which it is united by some condensed areolar tissue, and also with the canal of the urethra, which indeed appears to be channelled out in its substance; behind, it is connected with the rectum, superiorly by a double fold of peritoneum, and inferiorly by areolar tissue, which is less condensed than that existing in front. Hence, the rectum is seldom drawn upon in the displacements of the uterus, whilst the bladder always participates more or less in these accidents. The lateral borders afford attachment, above to the broad ligaments, and below to the pelvic areolar tissue and to some venous plexuses.

The internal face of the vagina is covered by a mucous membrane, continuous with that of the uterine cavity, excepting that its epithelium is not prolonged into the orifice of the latter, but terminates by a sort of denticulated border, similar to the relation of the œsophageal epidermis with the stomach; the internal surface also exhibits some wrinkles or rather some transverse elevations near the vulvar orifice. A raphé, or prominent ridge found on the median line, extends the whole length of the anterior wall of the vagina, affording origin to all those rugæ; but the raphé is not so well marked on the posterior parietes as on the anterior; the term *columns of the vagina* has been applied to these two ridges.

The transverse rugæ are much better developed in young virgins and aged females; but, on the contrary, during pregnancy, and for a short time after delivery, they are nearly effaced. These transverse rugæ have by some physiologists been regarded as organs of special sensation, and as designed to increase friction by the irregularities which they present.

[The upper extremity of the vagina embraces the neck of the uterus, to which it is attached, at the junction of the lower with the middle third. The neck is thus divided into two portions, an intra-vaginal and a supra-vaginal portion. At the point of insertion there is a true continuity of tissue between the vagina and uterus, inasmuch as on the one hand the vaginal mucous membrane is simply reflected so as to form the mucous membrane of the os tincæ, whilst on the other, the muscular fibres of the vagina are directly continuous with those of the uterus.]

In thus folding upon itself in order to embrace the neck, the mucous membrane of the vagina forms a circular groove or cul-de-sac, described as the *anterior* and *posterior cul-de-sac*. The posterior one is, generally, deeper than the anterior, owing probably to the insertion of the vagina behind, upon a more elevated point of the neck.

The inferior extremity, or vulvar orifice, presents, in front, a transverse rugous prominence, that seems to diminish the entrance.

Structure of the Vagina. — [The walls of the vagina average in thickness from one-eighth to three-sixteenths of an inch. It is composed of three layers: one external or cellulo-fibrous; a middle or muscular one; and the internal or mucous.

The external layer is composed of fibres of both elastic and connective tissue; it blends externally with the organs surrounding the vagina, and internally with the middle layer.

The middle layer is composed of muscular fibres which are inserted in front upon the branches of the ischium and pubis, and are continued upward to become blended with the middle layer of fibres of the uterus. Some again disappear upon the utero-sacral ligaments, whilst others cross each other in all directions, leaving interspaces occupied by projecting veins.

The internal or mucous layer is of a pale-red color, which becomes violet during menstruation and especially during pregnancy. Its external surface is confounded with the preceding layer, whilst its internal is covered with tessellated epithelium and abounds in folds analogous to papillæ. For a long time this membrane was supposed to be rich in mucous follicles, but anatomists now agree in the opinion that the vagina is destitute of mucous glands.

In great part, the walls of the vagina are composed of a tissue possessing all the characters of spongy erectile tissue; that such is the case has been proved beyond cavil by the researches of M. Kobelt and Ch. Rouget.]

According to Kobelt, this erectile tissue is composed of several superposed layers of venous network which proceed from the bulb, the finest ramifications extending into the mucous membrane. This true spongy body extends continuously through the entire limits of the vestibule and of the vagina, and seems connected with the veins of the parenchyma of the uterus. The great vascularity of the walls of the vagina explains, to a certain extent, the dangers consequent upon their rupture. Surrounding the lower extremity of the vagina are a few muscular fibres, that constitute what is erroneously called (see below) the constrictor vaginæ muscle. In some females, this is quite strong and well developed.

Finally, under the name of *bulb of the vagina*, a swelling or cavernous body is described, that separates the orifice of this canal from the roots of the clitoris: moderately thick in the centre, where it is placed between the meatus urinarius and the junction of the cruræ clitoridis, it gradually swells out, as it recedes from this point, and terminates below in an enlarged extremity on the sides of the vagina, being deficient, however, on the posterior wall of this canal. The length of the bulb, when injected, is about one inch and three-eighths of an inch; its greatest width, from one-half to three-quarters of an inch, and its thickness from about three-eighths of an inch to one-quarter of an inch. (Kobelt.) The bulb of the vagina is composed of an erectile tissue analogous to that of the bulb of the urethra in the male, and communicates freely, as shown by M. Deville, with the cavernous tissue of the clitoris, by means of several veins of considerable size.

The bulb of the vagina is surrounded, as it were, by a layer of muscular fibres (*constrictor cunni*), in regard to the arrangement of which authors differ. According to Kobelt, there are two constrictor muscles. It takes its origin by a large and flattened base from the aponeurosis of the perineum, almost directly at the middle of the space which separates the anus from

the tuberosity of the ischium; thence it rises, becoming at the same time narrower towards the clitoris, and covers or rather embraces in the shape of a half cylinder the entire length and width of the bulb of the vagina.

A closer examination, says Kobelt, shows that this muscle is composed of two flattened layers, the deeper of which glides in between the upper border of the bulb and the root of the clitoris, and so appears above the urethra to unite with the muscle of the opposite side; the upper layer, on the contrary, which is also flat, rises upon the back of the clitoris, and is connected with its fellow by a flat and narrow tendon.

This muscle, which is, in fact, at a considerable distance from the vaginal orifice, has been erroneously regarded as a sphincter of the vagina. Now its power to diminish the orifice of the vagina is but momentary, and only by compressing the bulb when greatly distended at the moment of coition. Its proper office is, in fact, that of a compressor of the bulb, whilst its upper extremity tends, at the same time, to depress the gland of the clitoris towards the vestibule.

Vessels.—The vaginal arteries come from the hypogastric; the veins are very numerous and plexiform, and discharge into the hypogastrics; the lymphatics empty into the ganglions of the pelvis, and the nerves arise from the hypogastric plexus.

The vagina serves in the female both as the organ of copulation and as the canal for the passage of the menstrual fluid, and for that of the product of conception.

ARTICLE II.

OF THE UTERUS.

The uterus is the organ of gestation, in which the ovum is destined to remain, from the period of its escape from the Fallopian tube, until the moment of final delivery.

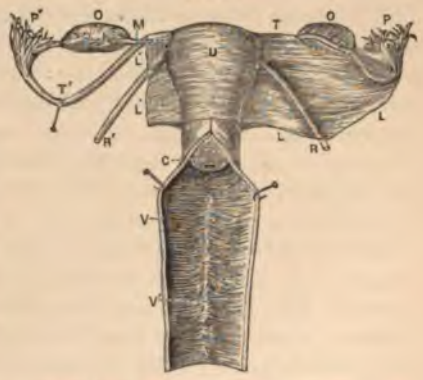
In form, it resembles a small gourd, or a pear flattened from before backwards, having its base turned upwards and the apex downwards.

The organ is divided into two parts, the superior of which, called the body, is the largest, and comprises more than half the total length; the other, or inferior portion, styled the neck, is smaller; a slight circular constriction serves to indicate externally the point of union of the body with the neck.

The axis runs from above downwards, and from before backwards, corresponding nearly with that of the superior strait.

It is situated in the excavation,

Fig 23.



The Internal Genital Organs. (Tarnier.)

U. Uterus, anterior face. O O'. Ovaries. P P'. The pavilion. C. The intra-vaginal portion of the neck of the uterus. R R'. The round ligaments. V V'. The vagina laid open. L L'. Large ligament. M. The ligament of the ovary. T T'. Fallopian tubes.

usually on the median line, between the bladder and rectum, being retained in position by the round and the broad ligaments on the sides, and below by the vagina, upon which it rests.

[The situation of the uterus is affected by the fulness or emptiness of the bladder. When the latter is empty, the uterus is near the pubis and the neck directed backward. When the bladder is full, the uterus is pushed back, and its axis corresponds nearly with that of the vagina.]

As we have said before, the neck of the uterus is embraced about its middle by the mucous membrane of the vagina, being thereby divided into two portions, of which the one situated above the insertion of the vagina is called the superior vaginal; and the other, which projects into the upper part of that canal, is termed the inferior vaginal portion of the neck.

The connections of the uterus are very loose and extensible; it therefore exhibits a great degree of mobility, and may easily be moved in every direction.

Its volume varies with age, being quite small prior to the fifteenth year, but augmenting rapidly at this era; the womb never resumes completely its primitive dimensions in women who have borne children, and finally, in advanced age, it often appears to waste away, and to dwindle down to the size it had prior to the fifteenth year. Its dimensions after puberty are as follows, viz.: The vertical diameter varies from two and five-eighths to two and three-quarter inches; the transverse one, at the fundus, one and three-eighths to one and a half inches. Certain physiological conditions produce a great augmentation in its volume. For instance, I have frequently observed at the approach of the monthly courses, that it presented twice the ordinary size at least, and in some women the increase in volume is so marked at this period as to be mistaken for the commencement of a pregnancy. (See *Diagnosis of Pregnancy.*)

The uterus likewise varies in situation at different epochs; thus it surmounts the superior strait in the fœtus, and rests in the abdominal cavity, so that the Fallopian tubes and ovaries occupy the iliac fossæ, the fundus uteri corresponding to the fifth lumbar vertebra. After birth, in consequence of the development of the pelvis, it appears to sink gradually into the excavation, and, at ten years, the fundus is on a level with the superior strait, but subsequently gets below this point. The womb is generally inclined to the right or left in aged females, or is turned backwards on the rectum.

The axis of the uterus approaches that of the inferior strait in many women, especially in those having a short vagina. It must further be observed, that the direction described by us as normal, is far from being constant in all women; thus, in some cases, the fundus may be thrown so far forwards as to render the anterior wall the most inferior part, thereby constituting what pathologists have described as an *anteversion;* in others, the superior border is thrown towards the most inferior portion of the sacrum, the neck being carried behind the posterior face of the pubis, thus producing a *retroversion;* again, it is often turned towards one side of the excavation, the neck being directed to the opposite side: this is *lateral version*

Another singular anomaly in the relative direction of the axis of the body and that of the neck of the uterus remains to be described. In the normal condition, the axis of the neck seems to be identical with that of the body, and to be simply a continuation of it. Now, in some subjects, the body of the uterus is found to form with the neck an angle which approaches more or less to a right angle, as though one of these parts had been strongly bent upon the other, like the body of a retort upon its beak. This inflexion may take place anteriorly, posteriorly, or laterally, and has been styled accordingly, *anteflexion*, *retroflexion*, and *lateroflexion*.

This alteration in the relation of the axis of the body with that of the neck of the womb may occur accidentally, and we have several times observed it as a consequence of anteversion or retroversion, but certainly it is often congenital, and then, should it remain after puberty, and especially should it increase in extent, it might become a cause of sterility.

The relative height of the fundus and neck of the uterus, the plane of the os, and the axis of the body are indicated in Fig. 23*a*, in which the bladder, *B*, and the rectum, *C*, are represented as moderately distended. As said before, the situation of the uterus is subject to continual change, being effected by fulness or emptiness of the bladder. When the bladder is empty, the abdominal viscera press upon the fundus of the womb and bend it forward. This inflection is regarded by many as permanent and inherent to the uterus itself.

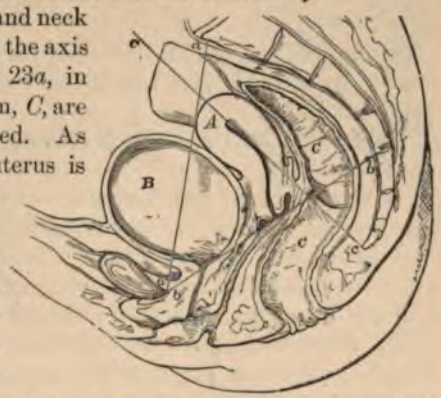


FIG. 23*a*. Diagram, showing relative position of pelvic viscera (Farre).

The weight of the womb, in girls at puberty, is from six to ten drachms; but in women who have had children, it ranges from an ounce and a half to two ounces; and from one to two drachms in very aged females.

The uterus exhibits an external and an internal surface.

§ 1. External Surface.

In the study of the external surface we should recognize the division into the body and the neck.

Of the Body of the Uterus.—The external surface presents for our study two faces, two borders, a base, and an apex.

The anterior face of the body is slightly convex, is covered by the peritoneum on its superior three-fourths, and lies in a mediate relation with the posterior face of the bladder, from which it is frequently separated by some folds of the small intestine; whilst, at the inferior fourth, it is in contact with the bas-fond of the bladder, to which it is united by some loose cellular tissue. This latter connection explains the frequent participation of the bladder in the uterine displacements, however inconsiderable they may be, as also how in certain cases vesico-uterine fistulas may be produced after difficult labors.

The posterior face is much more convex than the preceding, being covered throughout its whole extent by the peritoneum; it is in a mediate relation with the anterior surface of the rectum, the intestinal convolutions, however, often separating them; it may be readily examined through the rectum. The lateral borders are slightly concave, affording an attachment to the broad and the round ligaments; but, as M. Cruveilhier remarks, these ligaments are attached to the anterior edge of the borders, and hence all the thickness of these margins is found behind the broad ligaments, and consequently the latter are on the same plane as the anterior face of the womb.

The base, fundus, or superior border of the womb is convex, looking upwards and forwards, and covered by the convolutions of the small intestine. It never attains the level of the superior strait in the unimpregnated state, and therefore it is only possible to feel it through the inferior abdominal wall, by using great pressure.

At the junction of this base with the lateral borders of the body the two angles are formed, from which the Fallopian tubes and ligaments of the ovary arise.

The apex or inferior angle is continuous with the neck, which next claims our attention.

Of the Neck of the Uterus.—Very remarkable differences are found between the neck of the uterus in a woman who has borne children, and that in one who has never been a mother; we shall, therefore, consider it successively in each, because the modifications it undergoes during pregnancy can only be appreciated after a careful study of the ordinary condition.

1st. *In the woman who has never been a mother*, the neck of the uterus is from an inch to an inch and three-eighths in length, and is separated from the body by a narrow, constricted portion, which can easily be distinguished, even on the exterior of the organ. At the central part, where it is a little enlarged and fusiform, it is about three-quarters of an inch in the transverse diameter, and half an inch in the antero-posterior one. Near the junction of the superior third with the inferior two-thirds, it is embraced by the upper end of the vagina, which descends a little lower on the anterior than on the posterior face, whence the subvaginal portion of the neck is somewhat longer behind; but the contrary is true for that part above the vagina.

The cervix is terminated by an extremity that is less voluminous than the other portions of its extent, so as to present a conical form to the finger. This extremity bears the name of the *os tincæ*, or tench's mouth. The os tincæ presents two lips, separated by a small transverse fissure, somewhat swollen in the middle, called the external orifice of the neck. The orifice is sometimes difficult to find in a young marriageable girl. But, according to Dubois, if the index encounters it, we may recognize the part by comparing the sensation then experienced with that produced by applying the pulp of the finger upon the extremity of the nose, and feeling the depression between the alæ nasi. The anterior lip is the thicker, though both are very nearly of the same length, the anterior one, perhaps, descending a little lower than the other. Most authors teach that the anterior lip of the neck

descends lower than the posterior. In detaching the uterus from a dead body, no great difference, however, is observed in this respect, but, on the contrary, if we touch a female, the distinction is much better marked. I believe this results solely from the fact of the neck being directed a little posteriorly, so that the surface of the os tincæ is not horizontal, but inclined backwards; and, therefore, the anterior lip is necessarily somewhat lower than the posterior. Besides, the finger in passing from below upwards, and from before backwards, must first encounter the anterior lip, and is then obliged to go higher and further behind to reach the posterior one. These lips are smooth and polished throughout, neither presenting any inequalities nor any depressions; in fact, the whole external surface of the neck is equally smooth, and without elevations.

The cervix, as already stated, is slightly directed backwards, so that, if prolonged, it would terminate near the coccyx, or the most inferior part of the sacrum. It is situated in the upper half of the excavation, yet the finger can easily reach and pass over its whole exterior surface.

FIG. 23*a*.

Differences in the uterine neck and its external orifice.
a et *c*, of the nulliparous.
b et *c'*, of the multiparous.

2d. *In the female who has had several children*, the neck has not the same aspect, and the length is so variable that it is not possible to announce it in advance; though we may say, in general terms, that it is shorter in proportion to the larger number of children the woman has borne, a portion of it seeming, as it were, to have been destroyed at every labor. Two females, one of whom had seventeen, the other nineteen children, have been under my care; the neck in each was completely destroyed in its intra-vaginal portion.

This diminished length of the intra-vaginal portion of the neck in women who have borne many children, is due to the strong traction upon the upper extremity of the vagina in the preceding pregnancies, produced by the elevation of the uterus; in consequence of this traction, and the laxity of its adhesions with the middle part of the neck, the vagina becomes detached from it at that point, and adheres to it only at its inferior extremity. When this has occurred, it is plain that the portion which projects into the vagina must be much less considerable than before. Although it still preserves a certain length, the regular form that it previously had is wanting, for it is no longer a fusiform body, with an exterior surface polished and smooth everywhere, but a kind of irregular teat, covered on its external face by more or less numerous elevations.

Sometimes it is more swollen at the inferior portion, whilst the upper part appears to be hollowed out in its whole circumference by a deep excavation.

The orifice of the os tincæ is sufficiently patulous to admit the extremity of the finger, or even one-half of its ungual portion may occasionally be introduced. The lips are unequal, presenting a variable number of notches Being rarely found on the middle part of the lips, these depressions are continually met with about the level of the commissures, and more frequently

on the left side than the right. They result from the lacerations that have occurred in former labors, at the moment when the head cleared the os uteri; and the lochial discharges have prevented the lips of these little wounds from uniting, and they have cicatrized separately. The depressions are sometimes so numerous as to subdivide the lips into six or eight small tubercles, separated by as many fissures of variable depth.

In case the woman has not had children for several years, and more especially if she has had but one or two of them, these characters are much less determined, the orifice is nearly obliterated, and the neck has gradually resumed its primitive form; nevertheless, the fissure of the orifice is always sufficiently marked, as well as the inequalities on the lips, to indicate antecedent labors. These marks may become more and more faint, but they never disappear altogether.

The frequency of these depressions on the left side may be, I think, readily explained. When the head passes through the neck, it is evident that, if a laceration be produced, it will be at the point which sustains the greatest strain. Now, the left occipito-iliac positions being much the more frequent, the occiput, which constitutes the largest extremity of the head, will consequently correspond to the left commissure of the neck. Further, the uterus is habitually inclined to the right, so that the line of its contractions is directed from right to left, and, therefore, acts more energetically on the left side of the cervix. Hence the greatest strains occur at this point.

§ 2. Internal Surface.

[The uterus has an internal surface which defines its cavity. This cavity has, in the virgin condition, a longitudinal extent of about two and a quarter inches, and of two and a half inches after several labors. We may distinguish the cavity of the body and the cavity of the neck. The length of the former is, in virgins, rather less than that of the neck, whilst in multiparæ the two dimensions are nearly equal;—that of the body being, perhaps, rather greater than that of the neck.

A *The cavity of the body* is triangular in shape, having two faces, three edges, and three angles. The two faces are plane, and separated only by a thin layer of mucus, so that they may be said to be in contact.

Fig. 24.

Cavity of the Uterus and the Fallopian Tubes.

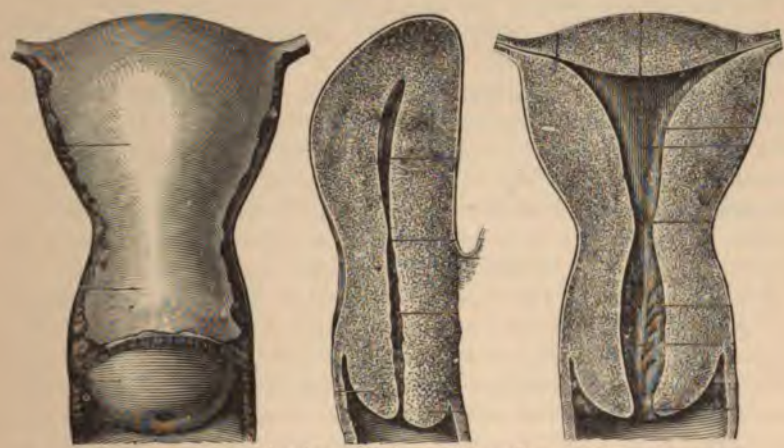
A. Superior border or fundus of the womb. B. Cavity of the womb. C. Cavity of the neck of the uterus. D. The canal of the Fallopian tube cut open. E. The fimbriated extremity or pavilion, likewise laid open. F F. The ovaries, one-half of which has been removed so as to bring into view several of the Graafian vesicles. G. The cavity of the vagina. H H. The ligaments of the ovaries. G G. The round ligament.

Of the three edges, the upper extends from the orifice of one Fallopian tube to the other, and the two lateral ones, from the orifice of each tube to the upper or internal orifice of the neck. In virgins, the three edges are curvilinear, with convexity directed inward; in multiparæ, they are either rectilinear, or present a slight curvature with concavity directed internally.

The three angles are described as the superior or lateral, and the inferior. The two superior angles are at the extremities of the upper edge where it joins the lateral edges, and where are situated the very minute orifices of the Fallopian tubes. The inferior angle, formed by the convergence of the two lateral edges, also presents an opening in the internal orifice of the neck, by which the cavity of the body communicates with that of the neck.]

In the state of vacuity, no cavity, to speak correctly, exists in the womb, for the uterine walls are in contact throughout their extent; the cavity

FIG. 25.



Virgin uterus. *a.* Anterior view; *b.* Median section; *c.* Lateral section. (Sappey.)

like that of the pleura for example, has a real existence only when the walls become separated by a liquid effusion.

The congenital deficiency of a cavity in the body is very rare, but yet no trace of it existed in a uterus presented to M. Cruveilhier by M. Rostan, although that of the neck remained. In aged women, however, it is not very rare to find the cavity partly effaced by more or less extensive adhesions.

B. The *cavity of the neck* is fusiform, flattened from before backwards, and presents an assemblage of rugæ on its anterior and posterior walls, which constitute a median vertical column upon each wall, occupying the whole length of the neck, and from which a number of smaller columns pass off at various angles, representing a fern in relief. The term *arbor vitæ* has been applied to these rugosities. After delivery they frequently disappear, but sometimes they still persist.

The uterine cavity likewise exhibits a variable number of transparent vesicles, mistaken by Naboth for eggs, hence they have been called the

ovula Nabothi. These vesicles are nothing more than simple muciparous follicles, and they are particularly abundant in the neighborhood of the neck. They secrete a gelatinous mucus, which may accumulate in the cavity of the neck, and so obstruct it as to render fecundation impossible.

The internal surface of the uterus is much more vascular in the body than in the neck. This difference is particularly well marked in women who have died during the menstrual period. The cavity of the body is of a rose color, and that of the neck of a pearly gray hue, which is probably due to the slight vascularity of this part in comparison with that of the lining membrane of the body.

§ 3. STRUCTURE OF THE UTERUS.

In the ordinary condition of the womb, this structure is difficult to make out, but it becomes much more evident during the period of gestation.

The constituent parts of the organ are: a middle or tissue proper, an external peritoneal membrane, and an internal mucous one, together with numerous vessels and nerves.

A. *Tissue Proper.*—This tissue is of a grayish color, and is very dense in structure, creaking like cartilage under the scalpel. In general, the neck appears less firm in consistence than the body, resulting, as M. Cruveilhier supposes, from the former being the more frequent seat of sanguineous fluxions. It sometimes happens, as after a suppression of the menses, or just before or after menstruation, that the uterus has a more decided red color and its tissue is more supple. (See *Menstruation.*)

The proper tissue of the womb is composed of fibres disposed lengthwise. The nature of these fibres has led to numerous discussions, but at the present day they are proven by the microscope to be muscular, and since this muscular nature becomes clearly evident towards the end of gestation (see *Pregnancy*), we must acknowledge that, notwithstanding the fibrous appearance of its tissue in the unimpregnated condition, the fibres composing it are not the less muscular in their structure. This organization is concealed by the state of condensation; of atrophy, maintained either by inertia or want of action; but which becomes distinct, in consequence of the very considerable determination to the uterus, of its distention, and of the development of its fibres during pregnancy.

According to most anatomists, the direction of these fibres in the state of vacuity is very irregular, and their inter-crossing is nearly inextricable, as every one must confess, in this particular condition, says M. Cruveilhier. But as the structure of the uterus, except in gestation, is not of any consequence (practically speaking) to the accoucheur, we refer to the article *Pregnancy* for the more particular study thereof.

B. *The External or Peritoneal Membrane.*—The peritoneum having covered the posterior face of the bladder, is reflected upon the anterior one of the uterus, covering only its superior three-fourths; and having reached the fundus uteri, and gained the posterior wall, it covers this entirely, is prolonged on the vagina for a short distance, and is then reflected upon the

rectum. The broad ligaments are produced by the transverse elongations of this membrane; and its falciform folds, seen in the interval that separates the bladder from the uterus, are called the *vesico-uterine*, or the *anterior ligaments;* and those formed by it, between the rectum and uterus, are called the *posterior*, or the *recto-uterine ligaments*. The adherence of the peritoneum is quite loose on the borders of the uterus, but it becomes more intimate towards the median line.

c. *The Internal or Mucous Membrane.*—The existence of this membrane was for a long time contested, and there can be no doubt, that if a membrane resembling the majority of those which line all the mucous cavities be sought for in the uterus, it will be sought in vain. Still its existence is rendered very probable by the functions of the organ, for, as Cruveilhier has remarked: 1st. Every organic cavity communicating with the exterior is lined by a mucous membrane. 2d. Anatomy demonstrates that the vaginal mucous membrane is continued into the cavity of the neck, and then into that of the uterus. 3d. When examined by a lens, the internal surface of the uterus exhibits a papillary disposition, but the papillæ are imperfectly developed. 4th. This internal surface has follicles or crypts scattered over it, from which mucus can be squeezed out, and which, if their orifices be obstructed or obliterated, become distended by the liquid, and form little vesicles. 5th. It is continually lubricated by mucus. 6th, and lastly; the internal surface of the uterus, like all other mucous membranes, is subject to spontaneous hemorrhages, to catarrhal secretions, and to the mucous, fibrous, and vesicular vegetations called *polypi;* and it is generally admitted that, wherever there is an identity of action, there is also an identity of nature.

These physiological probabilities are at present fully confirmed by anatomical research, the numerous preparations in the possession of M. Coste leaving no doubt whatever as to the existence of the mucous membrane. I shall therefore borrow from this able physiologist the principal facts which pertain to its description.

The thickness of the uterine mucous membrane varies in different parts of its extent. Towards the middle of the body, it forms one-fourth of the thickness of the walls of the uterus; that is to say, its usual depth at this point is from one-eighth to three-sixteenths of an inch, amounting to about the one-fourth of the thickness of the uterine parietes. It thins off rapidly towards the point of union of the body with the neck, as also towards the apertures of the Fallopian tubes. Its greatest thickness in the neck does not exceed the one twenty-fourth part of an inch.

The thickness of the mucous membrane is clearly exhibited by the assistance of a perpendicular section of the uterus. It is then found to be injected, and varying in color from a deep or bright red to a semi-transparent reddish or pearly gray: the muscular tissue, on the contrary, is almost always of a reddish-gray color, and is besides easily distinguished by the numerous vascular openings upon the surface of the section, and from which blood may be caused to exude by pressure. In addition, there is always a

whitish line of demarcation between the two tissues, which becomes most distinct when the injection of the mucous membrane is greatest.

Its consistence is less than that of the tissue proper of the uterus, being very friable, and easily crushed.

Fig. 26

This figure represents the arrangement of the mucous membrane and of the tissue proper of the uterus, as also their relative dimensions.

A. Cavity of the neck and arbor vitæ. B. Cavity of the body. C. Mucous membrane. D. Intervening membrane. E. Represents the marked thinning off of the mucous membrane towards the neck.

It adheres very strongly to the substance of the uterus, and is separated from it with great difficulty: it is also incapable of any gliding motion upon the parts which it covers, on account of the entire absence of a sub-mucous cellular tissue.

Its internal surface presents a multitude of small orifices, rather regularly arranged, which, though barely perceptible to the naked eye, become very evident with the assistance of a lens. About forty-five of them are contained in a space equivalent to the square of one-eighth of an inch. They are the orifices of glands.

M. Robin has given an excellent description of the elements which enter into the composition of the mucous membrane; they are:

1. Embryo-plastic nuclei; 2. Elements of laminated tissue; 3. Special cells, in very small amount except during pregnancy; 4. Amorphous connective matter; 5. Glands; 6. Capillary vessels; 7. Epithelium, at first prismatic but becoming pavimentous during pregnancy. A few words in regard to the uterine glands.

Two species of glands exist in this mucous membrane, one being found only within the body of the uterus, whilst the other is confined to the neck.

1. According to M. Coste, who was the first to describe them, the glands of the body are especially visible when death has occurred during menstruation; they then appear as minute canals of about the one two-hundred-and-fiftieth part of an inch in diameter, placed vertically beside each other. They are, however, disposed so compactly, that the mucous membrane as seen by a lens appears to be formed of them almost exclusively. Their adherent extremities terminate in culs-de-sac and repose upon the muscular tissue. The bodies of the glands are rendered somewhat flexuous by the mucous membrane being too thin, as it were, in the state of vacuity, for the length of the tubes. They contain a whitish, viscid fluid, which may be squeezed from them, especially at the menstrual period.

2. The glands of the neck (glands, or ovula of Naboth) are found in all the interval between the line separating the cavity of the neck from that of the body, and the neighborhood of the borders of the os tincæ. Their orifices are readily seen upon, and especially between, the folds of the arbor vitæ.

These glands have the form of a minute cylinder, terminating in a rounded cul-de-sac, which is inflated into the form of a lentil or vial, and inclosed in the tissue of the mucous membrane, even descending a little between the fibres of the muscular structure.

The excretory orifice is always smaller than the glandular tube. Pressure causes the escape from it of a transparent, viscid, tenacious, and completely homogeneous fluid.

We shall treat hereafter of the modifications which these glands undergo during gestation.

[The epithelium of the uterine mucous membrane is cylindric, with vibratile cilia moving from without inward. It is therefore impossible that the ciliary motion should carry the spermatic fluid toward the openings of the tubes, as has been erroneously supposed.

The entire cavity of the body and of the neck, to a point near the external orifice of the latter, is covered with vibratile epithelium. Below this point the mucous membrane of the neck is furnished with the pavimentous variety.

D. *Vessels.*—The arteries of the uterus proceed from the hypogastric and ovarian arteries. Both present many flexuosities in their course through the tissue of the organ, and are remarkable for their corkscrew form, recalling the arrangement of the helicine arteries. The neck is less vascular than the body.

The veins are highly developed, anastomosing freely, and forming cavities, as it were, in the muscular tissue. They are called *uterine sinuses*, and communicate largely with the venous plexuses within the folds of the broad ligaments. From the latter proceed the uterine and ovarian veins which empty into the corresponding trunks.

From the arrangement of the uterine arteries and veins, surrounded as they are everywhere by muscular partitions, it results, that the uterus is a true erectile organ, as has been placed beyond doubt by an excellent memoir published by Professor Rouget. This skilful anatomist has, in fact, shown that by injecting the veins of the uterus the organ is put in a state of true erection, whereby it rises, swells, and moves up toward the abdomen. Under these circumstances its volume is greater by one-half than in the empty condition, and the walls of the cavity separate from each other. These phenomena doubtless take place during coition, and probably facilitate the ascent of the spermatic fluid.

The *lymphatic vessels* are very abundant, and pass into the pelvic and lumbar ganglia.

E. *Nerves.*—The nerves are derived from the great sympathetic, some of them proceeding from the renal and others from the hypogastric plexuses; to the latter are united some fibres from the sacral plexus.]

It is an important practical remark of M. Jobert, that the entire intravaginal portion of the neck is destitute of a supply of nervous fibres, whilst the portion above the insertion of the vagina receives a great number of them, which form species of plexuses, furnishing ascending or uterine

branches and descending or vaginal ones. The latter are extremely numerous, and ramify to infinity in the substance of the vagina.

This distribution, which would explain a number of physiological and pathological facts, needs confirmation from new researches, for recent preparations deposited by M. Boulard in the museum of the School of Medicine, give it a formal denial.

Development.—According to some authors, the uterus is bifid in the embryo as late as the end of the third month, but M. Cruveilhier says he has never observed this bifurcation. During the intra-uterine life, the volume of the neck surpasses that of the body, and at this period its largest portion corresponds to the vaginal extremity. After birth it remains nearly stationary until puberty, and then it acquires in a very short time the dimensions observed in the adult woman. The organ often becomes atrophied in old age.

§ 4. Ligaments of the Uterus.

We have already spoken of the anterior and posterior ligaments. The broad and round ones still remain to be described.

The Broad Ligaments.—As elsewhere stated, the double lamina of the peritoneum, which covers the anterior and posterior faces of the uterus, is prolonged transversely, the two folds resting against each other, and forming by their union a transverse partition, extending from each side of the uterus, which divides the pelvis into two cavities; the anterior of which lodges the bladder, and the posterior the rectum. Outwardly, and below, these ligaments are continuous with the peritoneum that lines the excavation; their superior border is free, and is extended from the angles of the uterus to the iliac fossæ—presenting three folds, called the wings. The anterior wing is not admitted by some anatomists; it is but slightly developed, and is occupied by the round ligament. The middle one incloses the Fallopian tube, and the posterior contains the ovary and its ligament.

[Between the two layers of serous membrane, whose apposition forms the broad ligament, are found two muscular layers, discovered and described by M. Rouget, who represents them as formed of muscular fibres making by their interlacement a network in a transverse direction. The anterior of these two layers is continuous with the superficial muscular fibres of the anterior surface of the uterus, and is directed outward so as to form a part of the round ligament. The posterior muscular layer is continuous with the superficial fibres of the posterior surface of the uterus, and is so directed outwardly as to become attached for the most part to the sacro-iliac symphysis.]

The two serous folds that constitute the broad ligament, are separated by a loose and very extensible lamellated cellular tissue, continuous with the *fascia propria* of the pelvis. The broad ligaments disappear during gestation, their two laminæ assisting to cover the anterior and posterior faces of the developed womb.

Bodies of Rosenmüller, Parovarium.—By the inspection of pieces prepared by M. Follin, we have become assured of the existence of an organ between the two laminæ of the broad ligament, which has not been even noticed

by French anatomists, but which certain German anatomists figure under the name of the *organ of Rosenmüller*, who was the first to discover it. Its general arrangement is not yet well understood, its development is involved in obscurity, and the details of its histology had not hitherto been described. It is at present known as the *Parovarium*.

The organ is composed of seven or eight tubes folded upon themselves, terminating in blind extremities, and all converging towards the tube which serves as a point of entrance for the vessels of the ovary. The tubes are generally closely approximated to each other, so that their inflexions frequently correspond. When examined by transmitted light, the assemblage of canals is distinctly seen in the broad ligament near the fimbriated extremity of the Fallopian tube. Sometimes these tubes are not very apparent, and their number is much less, yet some are always to be found. They exist at all ages, but are much more readily distinguished in the broad ligaments of the fœtus, or of children, for then the slight development of the blood-vessels does not obscure them, nor are they hidden from observation by the fat, which infiltrates the laminæ of the broad ligaments in adults.

Fig. 27.

Bodies of Rosenmüller.

A. Ovary.
B. Fallopian tube.
C. Fimbriated extremity of Fallopian tube.
D. Culs-de-sac of the tubes.
E. Canaliculi proceeding to the ovary.
F. Point to which the tubes converge.
G. Vesicle appended to the Fallopian tube.

The size of the tubes is variable: and they often present dilatations, and sometimes true cysts filled with a citrine fluid.

M. Follin has not been able to discover an *excretory orifice to these tubes, either in young girls or adult women.*

Their structure resembles that of the glandular tubes of many simple glands. They are provided with a central cavity, which presents the dilatations so often observed in tubes of this class. Externally, the tube is formed of cellular-tissue-membrane with longitudinal fibres. The internal surface of the tube is covered with pavement epithelium.

Some observations are calculated to produce the impression, without however confirming it, that this assemblage of tubes has, in its origin, some relation with the corpora Wolffiana.

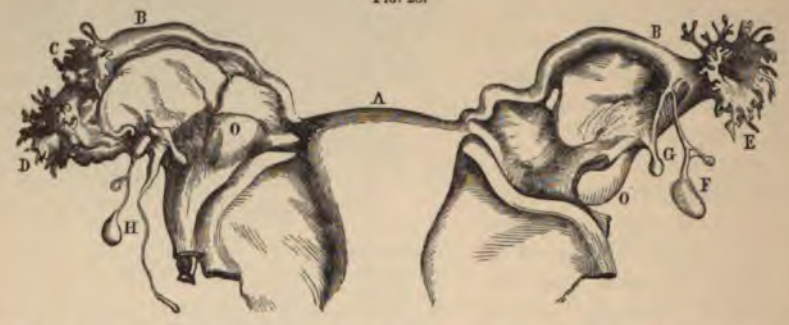
Attached to the free edge of the broad ligaments, it is not uncommon to find five, six, or even more small cysts. They are generally connected with the ligament by a very slender pedicle, of variable length, but which is sometimes so short, that the cyst appears to be sessile, and directly adherent to the ligament. (See Fig. 28.)

It is difficult to understand the mode of the development of these cysts. They may, perhaps, have some relation with the tubes of which the bodies

of Rosenmüller are composed. It has however seemed to us worth while to call attention to them particularly, as they are stated by M. Broca to be present in the great majority of cases.

The round ligaments, or supra-pubic cords, are evidently continuous with the tissue of the uterus, to which their proper substance is precisely similar; arising from the lateral border of this organ, below and a little in advance of the Fallopian tube, it runs upwards and outwards. According to M. Deville, this fringe, or ligament, is bent downward in the anterior fold of the broad ligament, and reaches the internal orifice of the inguinal canal, into

Fig. 28.



The figure exhibits the small cysts appended to the free edge of the broad ligaments. One of the Fallopian tubes is represented with a double fimbriated extremity, as in the case described by G. Richard.

A. Uterus. B. Fallopian tubes. C. The additional fimbriated extremity. D, E. The normal fimbriated extremities. F, G, H. The cysts described above.

which it enters, accompanied by a prolongation of the peritoneum, bearing the name of the Canal of Nuck. It then divides into a number of fibrous fasciculi, which are lost in the cellular tissue of the mons veneris and that which fills the dartoid sac, described as existing in the labia externa. According to Madame Boivin, the round ligament on the right side is the shorter and larger of the two. They contain a great number of veins, which are liable to become varicose.

These ligaments serve to retain the uterus in position, and to prevent its displacements; and it is probably to them that the pains in the groins, experienced by some women during chronic affections or displacements of the womb, may be referred. They are, in a great measure, composed of cellular tissue and vessels, but containing also some muscular fasciculi, the superior of which are prolonged from the uterus, and the inferior come from the transversalis muscle. The superior muscular fibres are much more evident during pregnancy.

Finally, the *vesico-uterine* and *utero-sacral ligaments*, formed, as we have stated, of folds of the peritoneum, which, after having covered the uterus, are reflected upon the posterior surface of the bladder and the anterior surface of the rectum; these ligaments are, so to speak, reinforced by collections of fibres which appear to be prolongations from the tissue proper of the womb, and which are attached anteriorly to the posterior surface of the bladder, and posteriorly to the anterior surface of the rectum.

ARTICLE III.

OF THE FALLOPIAN TUBES.

The *uterine* or *Fallopian tubes* are two canals, varying from four and a quarter to five inches in length, and placed in the thickness of the superior border of the broad ligament. They extend transversely from the lateral angles of the womb nearly to the iliac fossa on the corresponding side. Their volume is made more evident by inflating them. (G. Richard.) It may then be ascertained that beyond the uterine parietes, the tube has a diameter of about three-sixteenths of an inch; towards the middle of its course it increases to about one-quarter of an inch, and just before the *ostium abdominale*, to five-sixteenths of an inch. Their calibre is very variable at different points. The elasticity of the walls is however so great as to allow of their increase to an enormous extent, as is proved by the cysts which are frequently found in them.

The internal orifice of the tube (*ostium uterinum*) is stated by M. Richard to be the one-sixteenth of an inch in diameter; from thence, the calibre of the canal increases gradually to its external orifice. Near the free extremity it spreads out and becomes fringed. This termination constitutes the pavilion, or fimbriated extremity (the morsus diaboli).

It is generally taught that one of these fringes, which is longer than the others, attaches itself to the extremity of the ovary. On the contrary, M. Cruveilhier believes that this adherence takes place through the intervention of a groove, the concavity of which looks downwards and backwards, and facilitates the communication between the ovary and the cavity of the tube. All the fringed folds are attached to a small circle which is more contracted than the part of the tube which it terminates. This small circle is called the *external orifice of the tube.* The *internal* or *uterine* orifice is the name given to the one by which it opens in the uterine cavity.

[The Fallopian tubes are composed of three layers: an external or serous, a middle or muscular, and an internal or mucous layer.

The external layer is a part of the peritoneum which lines the entire length of the oviduct, and is extended to the free edge of the fimbriated extremity, where it ends abruptly.

The middle layer is composed of two planes of muscular fibres — the external being longitudinal, and the internal circular. The tubes have often been described as prolongations of the uterus, whereas M. Robin regards them as entirely distinct. A thin, cellular septum is, in fact, interposed between the tissues of the two organs, allowing of their separation by the scalpel.

The mucous layer is continuous internally with the uterine mucous membrane, and terminates externally upon the free edge of the fimbriated extremity where it is connected with the peritoneal layer. Thus affording the only example of a mucous membrane in continuity with a serous one.

The mucous membrane of the oviduct is devoid of papilli and glands, but presents longitudinal folds so adjusted to each other as to transform the canal into numerous capillary tubes, well adapted to convey readily the spermatic fluid to the ovary. The mucous membrane is also covered with a vibratile epithelium, the motion of whose cilia being directed toward the uterus are, doubtless, intended to impel the ovule toward the uterine orifice of the tube.]

A special artery, derived from the numerous branches with which the uterus is supplied, and two veins, which join the ovarian veins, constitute the vascular apparatus of the tube. It is provided with nerves from the spermatic and hypogastric plexuses.

The Fallopian tube serves the double purpose of a canal for transmitting the fecundating principle of the male, and for carrying the germ furnished by the female from the ovary to the uterus.

Injections into the uterus may pass through the Fallopian tubes into the peritoneal cavity and be a cause of peritonitis.

At each menstrual period the ovule passes with the serum current along the ovarian fimbriæ into the Fallopian tube. At this time, the vessels of the Fallopian tubes are engorged—the mucous membrane assumes a well-marked red color—the walls are thickened, and the canal is enlarged. The tubes are at the same time affected with peristaltic contractions, which are probably intended to propel the ovule into the uterine cavity.

The anomaly presented by the existence of supernumerary pavilions, or fimbriated extremities, upon the same tube, as described by M. Gustave Richard, is here deserving of notice. In the bodies of twenty women, selected at random, he observed it five times. One or several of them were found attached to the tube either immediately behind the normal fimbriated extremity, or at distances varying from three-quarters of an inch to an inch and a quarter beyond it; all of them were formed like the one which terminated the oviduct by the fringe-like division of the mucous membrane. By floating the fringes under water, an opening was discovered conducting into the tube, through which a stylet might be introduced and brought out through either the internal or external orifice of the tube.

According to Dr. Hamilton, of Edinburgh, the Fallopian tube undergoes some modification during gestation, to which he attaches great importance. as a characteristic sign of pregnancy. This change consists in the formation of a little pocket, or sac, about an inch from the fringed extremity. This partial dilatation of the tube, previously described by Roederer under the name of *antrum tubæ*, is certainly an exceptional fact. I have never observed it; and M. Montgomery has encountered it but once in fourteen uteri, examined in the state of gestation; so that it cannot have all the importance that certain authors wish to ascribe to it.

ARTICLE IV.

OF THE OVARIES.

The ovaries (*testes muliebres*) are the analogues, in the female, to the testicles of the male: that is, both of them secrete a product indispensable to reproduction. Two in number, they are situated on the sides of the uterus, in that portion of the broad ligament called the posterior wing, just behind the Fallopian tube. They are maintained in position by those ligaments, as also by a special one, denominated the *ligament of the ovary*.

The ovaries vary in situation, according to the age of the individual, and the state of the uterus. In the fœtus, they are placed, like the fundus uteri, in the lumbar region; but, during gestation, they rise into the abdomen along with the body of the uterus, upon the sides of which they lie.

Immediately after delivery the ovaries occupy the iliac fossæ, where they sometimes continue throughout life; again, it is not at all uncommon to find them turned backwards, and adherent to the posterior face of the womb

The ovaries vary in size, both from age, from the plenitude or vacuity of the uterus, and from health or disease. Being proportionably larger in the fœtus than in adult age, they diminish after birth, augment in volume at puberty, especially at the monthly periods, and dwindle away in old age. During pregnancy and after delivery, they acquire in some cases quite a considerable volume.

FIG. 29.

Ovary of the Young Female after Puberty.
A. Body of the ovary. B. Utero-ovarian ligament. C. Tubo-ovarian ligament. D. Fallopian tube. E. Fimbriated extremity of the tube.

Before the age of puberty, the external surface of the ovaries is of a light rose color, and is smooth and free from inequalities. In women who have menstruated for several years the surface is rough, fissured, covered with small blackish cicatrices, and sometimes with ecchymotic spots. Some of these cicatrices are linear, others are triangular or radiated; they are of a red color when recent, but become brown in the course of a few months. Sometimes a complete union fails to take place between their edges, leaving a small opening, which communicates with the ruptured cavity. After the period of life at which the menses disappear, the external surface presents numerous wrinkles, which are not, as has been supposed, the result of old cicatrices, but are due simply to the atrophy of the ovaries, and the plication of the external envelope which is the consequence.

The ovaries are ovoidal in shape, a little flattened from before backwards, and of a whitish color.

The external extremity of the ovary is adherent, as we have said, to one of the fringes of the fimbriated extremity of the Fallopian tube; the internal extremity is attached to the uterus by the ligament of the ovary, which is inserted at the corresponding angle of that organ.

The ligament of the ovary, which we have already considered, was for a long time regarded as a canal, designed like the Fallopian tube to convey the fecundated ovule into the cavity of the uterus; modern anatomy, however, proves it to be solid.

From the researches of Gartner, of Copenhagen, and of M. de Blainville, it appears that in some quadrupeds, and especially the sow, a canal is almost always to be found extending from its external orifice by the side

of the meatus urinarius (corresponding with a similar orifice on the other side of the meatus), through the substance of the muscular fibres of the vagina to the neck of the uterus; here the canal becomes narrower, but continues on, following the body of the uterus and imbedded in its fibrous structure, and finally leaves it to pass in a direction parallel to the corresponding angle into the substance of the broad ligament.

M. Follin found, whilst injecting the duct of Gartner in the sow, that he injected at the same time a long tortuous tube, situated in the substance of the ligament, at the point occupied in the human female, by the collection of glandular tubes which I have described. I have been able to determine the fact that in the sow this duct does not open by a large orifice at the lower part of the vagina, as has been represented, but in reality by a very narrow one. It is not terminated at its entrance into the broad ligament by a few brush-like divisions, as stated by M. de Blainville, but is continuous with a very fine tortuous tube which extends to the external extremity of that ligament. The duct of Gartner is furnished internally with a pavement epithelium, and communicates throughout its course with many glandular tubes finer than itself. (Follin.)

We have sought for this duct of Gartner in the human female, but found nothing which could be reconciled with the description given by him of it; however, we cannot avoid remarking that since these researches N. C. Baudelocque has observed in a woman a canal which seemed to be produced by a bifurcation of the Fallopian tube, and which, after passing through the entire uterine walls, opened into the upper part of the vagina near the neck of the womb. Madame Boivin and some others have met with a similar canal, and Mauriceau and Dulaurens considered it of quite frequent occurrence.

The arteries which supply the ovary are the spermatics, and proceed directly from the aorta.

The numerous small venous branches found in the ovary unite below the organ so as to form a plexus which gives origin to the ovarian veins; the latter emptying into the vena cava inferior, and into the renal vein.

The numerous lymphatic vessels with which it is provided contribute to the formation of the spermatic plexus, which itself empties into the lumbar plexus, and thence passes to the thoracic duct.

The nerves are derived from the great sympathetic.

§ 1. Structure of the Ovaries.

[The ovary consists of a special parenchyma inclosed by two envelopes, one of which is serous, the other fibrous.

The serous envelope is formed by the peritoneum and is closely attached to the subjacent one. It covers the entire gland except at its lower edge, where the two layers of peritoneum separate to allow passage for the vessels and nerves distributed to the ovary.

The fibrous envelope corresponds with the peritoneum by its external surface, whilst its internal surface is blended with the glandular parenchyma. It is much thinner than the tunica albuginea of the testicle with which it has been compared. M. Sappey even denies its existence, and regards the peritoneum as the only envelope of the organ; his opinion, however, is not yet adopted by most anatomists.

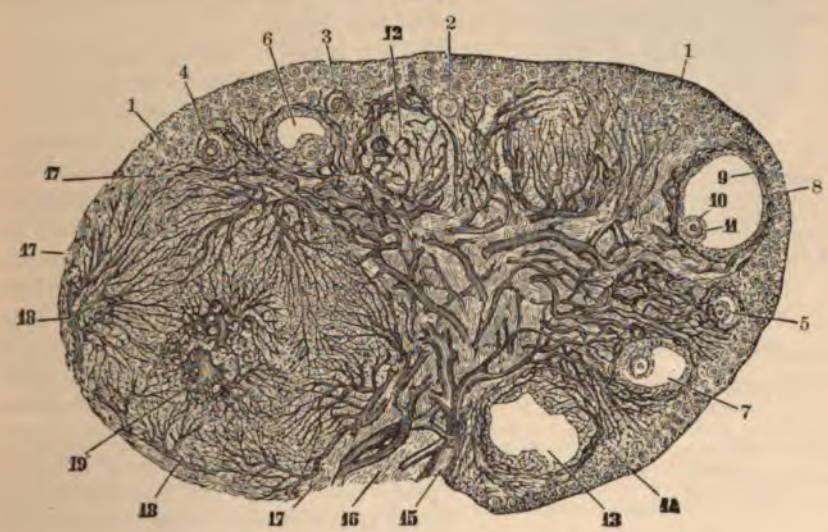
Within the envelopes mentioned, is a special tissue of a grayish-white color, termed the *stroma*, which is formed in great part by the interlacement of muscular fibres, some of which are peculiar to the ovary, whilst others are but a prolongation of the same kind of fibres as constitute the ligament of the organ. Other fibres take their origin from the Fallopian tube. The existence of all these fibres was shown by M. Rouget in 1858. With the muscular fibres are mingled others of connective tissue.

The arteries are situated between the muscular fibres, are flexuous, and have a spiral form. The veins, contorted in like manner, form a rich network which empties into a venous plexus immediately below the ovary. The arteries and veins, surrounded as they are by muscular fibres, form a true erectile organ, and the ovary is regarded as such by M. Rouget.

Within the fibrous structure of the stroma exist small cavities, called *ovisacs* or *Graafian vesicles*, of a size varying ordinarily from that of a millet-seed to that of a hemp-seed. Some of the more developed vesicles project from the surface of the ovary, where they acquire, as we shall see hereafter, a comparatively large size.

About fifteen or twenty vesicles may be readily distinguished in the adult female, but with the microscope many more are observable, all of which will be developed when the first shall have disappeared.

FIG. 30.



Section of ovary.

1. Cortical portion containing the ovisacs and ovules. 2, 3, 4, 5, 6, 7, 8. Follicles in different stages of development. 9. Epithelium of the follicle (membrana granulosa). 10, 11. Ovum with the discus proligerus.

M. Sappey's microscopical examinations have shown that in one healthy ovary of a woman of from eighteen to twenty years of age, the number of ovisacs and ovules is more than 300.000, making near 700,000 for the individual. He therefore calculates, that if all the ova existing in the surface of the ovaries of a young woman were to be fecundated and undergo all their phases of development, it would require but one woman to populate four such cities as Lyons, Marseilles, Bordeaux, and Rouen, and but two, to furnish inhabitants for a capital like Paris, containing 1,600,000 souls.

There are as many ovisacs in the fœtus as there will be at puberty, but as the

gland is then small, the vesicles conglomerated, but separate as the ovary develops. After puberty, the number of ovisacs lessens; in old women they disappear.

§ 2. Of the Ovarian Vesicles.

From birth to puberty the Graafian vesicles undergo no change. They have a rounded form and a diameter of $\frac{1}{125}$ of an inch. At puberty some of them have become developed, and, as stated, have attained the size of a millet-seed, of a hemp seed, or even of a pea.

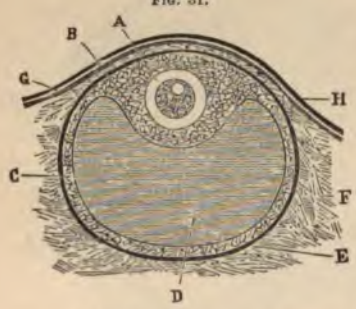
Each vesicle adheres firmly to the substance of the stroma in which it is lodged, and which forms for it a sort of retractile tegument. The special structure of each ovisac consists: 1, in a capsule or envelope; 2, of a contained body or nucleus.

1. The capsule or envelope is formed of a special, transparent, extremely thin, but resisting, non-contractile membrane. It is vascular and forms the vesicle containing the nucleus.]

2. *The Nucleus.*—The parts entering into the composition of the *nucleus* are: 1st, a granular membrane which incloses the humor of the Graafian vesicle; and 2d, a liquid produced by the aggregation of three humors of a different aspect, viz., a limpid mucosity, clear, though a little oily, a number of small rounded granulations, transparent in their central cavity, and slightly opaque at their periphery, and some oil globules. 3d, and lastly, an ovule floating in the midst of this liquid.

The *Granular Membrane* (see Fig. 31, G′).—A delicate membrane is found applied on the internal face of the Graafian vesicle, formed of granules, or rather of cellules, and bearing the name of the *granular membrane.* It tears with great facility, from its extreme tenuity; and hence many authors have denied its existence. Upon one part of the membrane (that corresponding to the free side of the vesicle) the granulations, or cells producing it, are more numerous or more compact, and in the centre of this compact mass, which has been called the *proligerous disk*, the ovule is found.

Fig. 31.



Ovule in the Graafian vesicle.
A. Ovule. B. Cumulus granulosus. C. Granular membrane. D. Cavity of the Graafian vesicle. E. Membrane proper of the ovisac. F. Stroma of the ovary. G. Fibrous envelope of the ovary. H. Peritoneal layer of the ovary.

The granulations, constituting the proligerous disk (see G, Fig. 31), are so closely united both with each other and with the latter, that upon opening the Graafian vesicle, even where the granular membrane is destroyed, this portion remains adherent to the ovule, forming round it, as it were, a granular bed. This membrane is entirely destitute of vessels.

§ 3. The Ovule.

Since the labors of Graaf, the majority of authors agree with him, that the ovule is constituted by the vesicle just described; but the honor of having first discovered the ovule, as a distinct organ in this vesicle, belongs to Charles Ernest Baër. The ovule is completely formed in the ovary during the earlier years of life. It is imbedded from the period of its maturity, as stated above, in the midst of a mass of granulations, which are more compact than those which fill the remainder of the vesicle.

It therefore occupies a fixed position in the vesicle, and is almost constantly met with at a point opposite to that whence the large vascular trunks spread out upon the ovarian capsule, that is to say, at the point which projects from the surface of the ovary. When examined with a lens, it appears as an opaque rounded body, at least more opaque than the liquid inclosed in the same vesicle; it is extremely minute, although the diameter of the little sphere it represents is subject to variations.

"The largest human ovules I have seen and manipulated," says Bischoff, "did not exceed the tenth of a line, being barely perceptible to the naked eye." When placed under a microscope, it is seen to consist of an exterior envelope, called the *vitelline membrane* (Coste), *transparent zone, cortical membrane,* or *chorion* (Baër), of a substance aptly compared to the yolk of an egg, and designated as the vitellus, and of another vesicle (placed within the latter) called the *germinal vesicle.*

FIG. 32.

A Non-fecundated Human Ovule.

A. The vitelline membrane, or transparent zone. B. The vitellus, or yolk. C. The vesicle of Purkinje, or the germinal vesicle. D. The germinal spot.

A. *Vitelline Membrane.*—If the ovule be examined by a magnifying glass of sufficient power, an obscure sphere will be brought into view, surrounded by a large clear ring, the nature of which it is difficult to make out. M. Coste has given the name of the vitelline membrane to this ring. It is evidently a thick membrane, the external and internal outlines of which assume the appearance of two circular lines inclosing a transparent ring. Many persons have merely considered it as a layer of albumen surrounding the yolk, but any one may easily convince himself that it is at least a resisting membrane, by cutting the ovule, or by compressing it by means of an instrument called the compressor; "for after proceeding in this manner," says Bischoff, "there cannot be a doubt that the transparent zone is an elastic, thick, hyaline, and transparent membrane, without a determinate texture."

Though entirely destitute of cells and vessels, it is nevertheless a living envelope; because, as soon as the ovum in the mammalia arrives in the cavity of the uterus, it becomes the seat of an active vegetation, and produces villosities which are more or less ramified. The latter, as they become developed, insinuate themselves into the tissue of the uterine mucous membrane, and thus attach the ovum to the place which it is to occupy for the future.

B. *Yolk or Vitellus.*—The cavity of the vitelline membrane is occupied, in great measure, by a granular liquid, that does not adhere to the exterior envelope, and even escapes from it readily when the latter is broken.

According to Bischoff, the yolk of a human ovum is formed of a coherent, indistinctly granular, transparent, and viscous mass, which does not run out when the egg is cut or crushed; each portion of the zone reserving its particular segment or yolk, or the latter escaping altogether.

"In certain cases," says he, "the vitelline granulations are not united in

a single mass. I have seen the yolk divided in two, and, on one occasion, into five parts of different volume."

The vitellus usually fills the interior of the zone completely, and has the same form, but sometimes the vitelline sphere is smaller than that destined to receive it. Some authors likewise believe that a very delicate membrane exists, which incloses and unites the yolk in a single mass; but Messrs. Coste and Bischoff agree in rejecting the existence of this, and contend that the granulations of the vitellus are placed in juxtaposition with the transparent zone, which forms its sole and only envelope.

C. *Germinal Vesicle.*—In the midst of the vitellus, in very young girls, or on one of the neighboring points of the peripheral envelope in the matured ovules, a small, perfectly transparent, and colorless vesicle is seen like a clear spot, surrounded by a mass of a deeper yellow. Purkinje had described it in the eggs of birds, and gave his own name to it; but M. Coste is entitled to the honor of having first demonstrated its existence in the ovum of mammiferæ, and of thus having established the perfect identity between the latter and the eggs of birds. This is the vesicle of Purkinje, or the *germinal* vesicle. It is slightly oval, and consists of a very delicate, transparent, and colorless membrane, which incloses a liquid that is frequently as limpid and transparent as itself, though it sometimes contains a few granules. Notwithstanding its extreme tenuity, this vesicle still offers a certain consistence, since it has been seen intact, after leaving the ovule, and being completely separated from the granular liquid in which it was placed.

It is always very small, and scarcely measures the sixtieth of a line in diameter.

D. *The Germinal Spot.*—If the germinal vesicle be attentively observed, an obscure rounded spot will be seen on some part of its periphery; this was first discovered by Wagner, who gave it the name of the *germinal spot.* It seems to be formed by the aggregation of fine small granules, or little globules, the obscure hue of which is brought out by the clear contents of the vesicle. Wagner has sometimes met with two, or even more, germinal spots in the mammiferæ.

Before fecundation, therefore, the ovule is composed: 1st, of an exterior envelope, the vitelline membrane, or transparent zone; 2d, of a vitellus, or yolk, contained in this vesicle; 3d, of a little vesicle inclosed in the first and swimming in the vitelline fluid — the germinal vesicle; 4th, and lastly, of the germinal spot.

EXPLANATION OF PLATE I.

MEDIAN PERPENDICULAR SECTION OF PELVIS FROM FRONT TO BACK, SHOWING BOTH PELVIC SPACES.

[*Taken from Savage on the Female Pelvic Organs.*]

A. *Anus*, marking the columns of Morgagni. R. *Rectum*, projections in the cavity, the valves (?) of Houston. These folds include *all* the coats of the rectum, and are readily effaceable by slight distension. Note minute circular markings at the anal end, indicating transverse sections of the inferior circular fibres of the rectum (internal sphincter), and lines near the coccyx indicating the posterior half of external sphincter, the coccygeal attachment of the pubo-coccygeal muscle, and the recto-coccygeus

muscle, or *retractor recti*, Luschka. U. Left half of the uterus; its central more vascular, erectile portion surrounded by its internal and external muscular cortex; its cavity a mere rima between its antero-posterior surfaces. V. *Vagina*, its muscular coats gradually losing themselves on the uterine neck up to its junction with the uterine body. B. *Bladder*, moderately distended; its outer longitudinal coat in front passing off to its attachments to the inferior edge of the pubic symphysis, and to the ligamentous process of the pubo-coccygeal muscle, bridging over the urethro-pubic venous plexus, separating that space from the vesico-pubic space above, which is bridged over by the vesical ligaments formed by the urachus and two remnants of the hypogastric arteries. C. *Section of Clitoris.* L. *Vulvar labium.* I. *Nympha.* P. *Perineal body*, black dots indicating the site of its many small vessels; behind it, anterior sections of the lower circular fibres of the rectum (internal sphincter). S. *Pubic symphysis* and vesico-pubic space. U. *Urethra*, inner longitudinal muscular coat surrounded by *m, m, outer circular coat*, those at U *constituting a true compound sphincter composed of organic and voluntary muscular fibres.* P, P. Vesico-uterine and recto-uterine (Pouch of Douglas) peritoneal folds.

CHAPTER IV.

OVULATION AND MENSTRUATION.

ANOTHER physiological phenomenon, namely, menstruation, is both excited by and dependent upon the evolution of the Graafian vesicles or ovulation. Ovulation and menstruation are, therefore, intimately connected and should be studied consecutively.

ARTICLE I.

OF THE MODIFICATIONS UNDERGONE BY THE OVARIAN VESICLES.

Until the age of puberty the Graafian vesicles are of small size; but at this period, some fifteen to twenty of them, which appear more advanced than the others, increase in size, and project from the external surface of the ovary. At the time when the young girl becomes nubile, one of the latter vesicles seems to have received a great increase of vitality; it undergoes a remarkable hypertrophy, and forms a projection upon the surface of the ovary; this projection becomes greater and greater until after some days it forms a tumor of the size of a cherry, or even of a small nut, upon the ovarian surface.

This considerable augmentation of size is due to the distention of the walls of the vesicle by an increased secretion of the fluid which it contains. In proportion as the development proceeds, the walls of the vesicle become thin; the vessels which supply them being compressed by the dilatation, lose their volume and become obliterated and atrophied, especially upon the point of culmination, where the resistance is least. When at last it has arrived at its full development, the ovarian capsule appears to remain stationary until an over-excitement, produced either by the maturity of the ovule, or by sexual intercourse, occasions its rupture. (Coste.) Then, the walls of the vesicle, although more and more distended, begin to lose their trans-

parency, on account of the hemorrhage which ensues. This is sometimes limited to the production of small extravasations upon the as yet entire walls of the vesicle, though most frequently a true effusion takes place within the cavity. The effused blood and the superabundant secretion increase still more the distention of the walls, which is finally carried so far that rupture becomes imminent, and it is possible to distinguish at the most projecting part of the tumor, the point where it is about to ensue. This point is generally indicated by a small reddish spot, of about a line in extent, produced by a strong injection, or even by a slight effusion of blood in the

FIG. 33.

FIG. 34.

FIG. 33. Showing the ovary, and a Graafian vesicle at its highest degree of development, and just before its rupture.[1]

A. The hypertrophied vesicle (drawn from nature, and of its real size). B, C, C. Radiated cicatrices, left by previously ruptured vesicles.

FIG. 34. The ovary, with the ruptured vesicle and the large clot that fills its cavity. (Drawn from nature.)

texture of the walls of the vesicle. (Raciborsky.) The thinned walls finally give way and tear gradually; the membranes of the vesicle itself being the first to yield, and after them the peritoneal layer. As a consequence of this rupture, the ovule is expelled, and carries along with it a part of the granular contents of the vesicle; it enters the Fallopian tube, the fimbriated extremity of which is prepared to receive it, and after traversing its canal arrives at a later period in the cavity of the uterus.

The walls of the follicle collapse after the rupture, and its cavity becomes filled with a small quantity of blood, which is found fluid or coagulated according to the time at which the examination is made.

The walls of the torn vesicle contract gradually, and the clot, which sometimes at first is the size of a small cherry, is slowly absorbed; the originally spacious cavity diminishes, the margins of the rupture approximate, so as even to become united occasionally by cicatrization, and order is finally restored.

The evolution just described, which is terminated by the rupture of a vesicle and the spontaneous expulsion of an ovule, is not an isolated face; on the contrary, it excites numerous sympathies in the remainder of the gen-

[1] This figure, borrowed from M. Raciborsky, is the exact copy of a preparation which he had the kindness to show me. But since that time (1843) I have never met with so enormously developed a vesicle, and I am disposed to believe that this great size is rather pathological than normal.

erative apparatus and throughout the organism of the female. We shall first study the generative organs and the modifications which they undergo before, during, and after this evolution.

The *ovary*, which produces the hypertrophied vesicle, is notably enlarged. It is of a deep red color, and its vascular apparatus is remarkably congested.

The *Fallopian tube* itself shares in the congestion, being often of a violet-red color, especially at its fimbriated extremity, which has a sort of velvety appearance. It is also endowed at this time with a special erethism, in virtue of which it applies its floating extremity upon the ovary, in such a manner as to receive the ovule and conduct it into its cavity.

The *uterus* undergoes such important changes that, before the discovery of spontaneous ovulation, it was erroneously supposed to play the principal part in the phenomena which we are about to study. I shall continue to draw from the beautiful works of M. Coste, from which I have already borrowed so freely in the preparation of this chapter, the principal features of the ensuing description.

Whilst the ovarian vesicle is undergoing the rapid evolution which we have just described, the vascular apparatus of the womb becomes developed and injected in an unusual manner; immediately beneath the delicate layer of epithelium which covers the surface of the mucous membrane, it forms in particular elegant reticulations, with irregular, lozenge-shaped intervals, surrounding the orifice of each of the numerous glandular tubes of which this membrane is almost entirely composed. This network is so fine as to give a violet hue of greater or less intensity to the internal surface of the womb, and is formed of very delicate venous ramuscules. The utricular glands increase perceptibly in size, and the muscular structure of the uterus, in consequence of the congestion which it undergoes, acquires greater extension, is of a more lively red color, and becomes more spongy and supple. The entire volume of the organ is increased, the neck is tumefied and its orifice narrower; the lips of the os tincæ are warmer and their color deeper.

The mucous membrane, in consequence of this development of its vessels, and especially of the glandules of which it is composed, has its thickness so much increased in proportion to the size of the uterine cavity, as to be thrown, in a great many subjects, into soft, projecting folds or circumvolutions, which are so pressed together as to leave no vacant space in the cavity of the organ. M. Coste has several wombs in his possession, whose mucous membranes measure at certain points, from two to three-eighths of an inch in thickness; still, to whatever degree the hypertrophy may be carried, it never presents the floating villi which Baër and Weber thought they had observed; neither, except in some pathological cases, does it ever exhibit the pseudo-membranous exudation which is acknowledged by almost all physiologists. (See *Deciduous Membrane.*)

This great vascularity of the mucous membrane, and the high vascular congestion which the entire organ undergoes, is at first accompanied with the exudation of a few drops of blood, which by admixture below with the vaginal mucus, which is itself at this period increased both in quantity and fluidity, communicates to it at first a rosy, and then a light reddish hue.

After two or three days, a flow of blood, derived principally from the superficial network of the mucous membrane, escapes through the neck and mingles with the vaginal secretions. Henceforth, the effusion presents all the characters of a true hemorrhage.

There can be no doubt that the chief source of this hemorrhage is the superficial vascular network of the mucous membrane; and in women who have died at this period the blood may be seen to transude through microscopic fissures.

The flow preserves the same characters during the two or three, be they more or less, days of its duration; then, as the quantity of blood diminishes, it resumes gradually the mucous and serous characters peculiar to the vaginal secretion.

It is impossible, in the present state of our knowledge of the subject, to determine precisely at what moment during the flow of blood the rupture of the Graafian vesicle takes place. The result of numerous autopsies admits of the supposition that this moment is variable, and the curious experiments of M. Coste leave no doubt whatever as to the influence which veneral excitement is capable of exerting upon it; this influence is so great, that it may determine the rupture of an hypertrophied vesicle, which, without sexual intercourse, would have remained intact for several days longer. However, it may be admitted, as a general rule, that the rupture occurs during the last days of the flow.

Fig. 35.

Uterus laid open, so as to exhibit the Hypertrophy of the Mucous Membrane at the Menstrual Period.

A. Mucous membrane of the neck. B. Mucous membtane of the body, much swollen. C. Thickness of the section of the mucous membrane. D. Tissue proper of the uterus. E, F. Diminution in the thickness of the mucous membrane at the neck and at the orifices of the Fallopian tubes.

The series of phenomena of which the ovary is the seat, is not terminated by the rupture of the vesicle, and it remains for us to state what becomes of its walls after the expulsion of the ovule.

Of the Corpora Lutea.—Immediately after the rupture of the Graafian vesicle and the consequent expulsion of the ovule, an effusion of blood, according to some, and of plastic lymph, according to others, takes place into the emptied cavity; moreover, the walls, which were greatly distended, retract strongly upon the effused matter, and form with it a more or less compact mass, which after a time assumes an orange-yellow color. From this latter circumstance, the tumor has acquired the name of the *yellow body*, or *corpus luteum*.

Although for a long time considered by nearly every author as an irrefragable proof of a previous conception, it is at present well known that

this body may exist in a virgin girl, provided she has previously menstruated.

Very different opinions have been promulgated as to the mode of formation of the yellow body, as also in regard to the precise period at which it commences. According to Robert Lee, the mass of this body is formed exteriorly, around the empty capsule of the vesicle, and consequently it has intimate connections with the ovarian stroma; but this opinion is inadmissible.

From the observations of Baër and Valentin, the yellow body results from the hypertrophy, or a kind of puffing up, of the membrane of the vesicle, which throws out a species of vascular processes that serve to fill up the whole cavity of the follicle, excepting at the part occupied by the ovule. In the latter view, as well as in that entertained by Montgomery, the development of the corpus luteum will aid in rupturing the vesicle, by the distention it produces, and will soon after determine the expulsion of the ovule, by pressing it gradually towards the thinnest part.

Both suppose that the *corpus luteum* is completely developed when the vesicular rupture and the discharge of the ovule take place, which, however, appears altogether inadmissible to me. I am convinced to the contrary, from the specimens which M. Raciborsky has had the kindness to show me. In a female, who died during menstruation, I was enabled to prove the recent rupture of a vesicle that was very much hypertrophied; its cavity, however, did not contain a yellow body. This does not, therefore, precede the rupture of the vesicle. In my opinion, M. Raciborsky has perfectly described the phenomena, consecutive to this rupture, in the interesting treatise published by him (*De la Ponte Periodique chez les Femmes et les Mammifères*, 1844). It may prove useful to publish his views in this work.

"If the ovaries be examined eight, ten, or twelve days after the cessation of the menstrual discharge, a small, rounded tumefaction, surmounted by a red spot like an ecchymosis, and presenting in its centre a slight linear fissure, will be found on the surface of one of these organs. The margins of the fissure are agglutinated, even this early, in the majority of cases, but it is still easy to separate them by using lateral tractions. If the ovary be then opened at the ecchymosed spot, the interior will exhibit a pouch, already smaller than the cavity of the vesicle before the rupture, but entirely filled by a clot of blood, which, when placed in alcohol, has the consistence of a solid body, though somewhat spongy in its nature. The clot is usually about the size of a medium cherry (see Fig. 34), and may be raised from its cavity without difficulty. The parietes of the vesicle exhibit, at this period, a yellowish hue, that disappears in spirits of wine. The surface of the membrane is at once slightly plaited and downy. In the meanwhile, the most soluble molecules of the clot are absorbed, and then a further retraction of the tunic takes

Fig. 36.

The ovary laid open longitudinally, and showing the corpus luteum at a certain stage of its development.

place. Being continually forced to follow the diminution of the clot, and to become moulded upon it, it forms anew a certain number of folds, which finally adhere to each other, and thus diminish the surface of the membrane. Afterwards, a new absorption of soluble parts, a further retraction of the tunics, a fresh diminution of the cavity, &c., &c. Whence, at the end of a month, the only remnant of the pouch, that could once have contained a small cherry, is but a little spot, that would hardly inclose its stone." (See Fig. 36.)

The tunic of the vesicle becomes hypertrophied whilst undergoing the forced plaiting, caused by the incessant retraction of the peripheral fibres, thus constituting a radiated mass, which, from the imbibition of the coloring principles of the blood, assumes a very characteristic orange-yellow color.

This coloration is not produced, as M. Montgomery and several others supposed, from the deposit of a substance of a new formation, either externally to, or within the vesicle, or between the two tunics that constitute its walls, but is simply the result of imbibition. Finally, the absorption of the clot being complete, the two opposed walls of the pouch, in time, approach each other, and thenceforth form merely a single slate-colored line. The vesicular cavities are reduced to this condition in from four to six months.

Both M. Coste and M. Raciborsky acknowledge the folding of the membrane of the vesicle, but the theory of the former in relation to it differs so much from that of the latter as to make it our duty to explain it briefly.

Immediately after its rupture, the ovarian follicle becomes filled with a gelatiniform matter, which often receives a *red color* from the blood which escapes from a few opened vessels; the matter itself assumes at a later period a greater consistency. By the spontaneous retraction of the walls, as we have already explained, they are promptly thrown into folds, and the rugæ which result from retraction are so numerous, so prominent, and so compact, as to bear some resemblance to the circumvolution of the brain. (See Fig. 37.) Contemporaneously with this folding, the wall becomes hypertrophied and inflamed; it assumes a red color, and encroaches more and more upon the cavity which it finally fills, just as though it had given rise to granulations. Ere long, however, the plastic matter which at first filled the follicle, having been gradually absorbed, the juxtaposed circumvolutions contract intimate adhesions with each other, and the replete follicle forms a large tumor upon the surface of the ovary.

Long before the folds or circumvolutions which tend to fill up the cavity of the ruptured follicle are so tumefied as to come in contact, their tissue loses the inflammatory redness which it at first possessed. But as M. Coste does not recognize the formation of a clot of blood in the vesicular cavity, he cannot admit with M. Raciborsky that the yellow hue of the mass just described is due to the imbibition of its coloring matter. On the contrary, he considers the color to be due simply to the nature of the molecular granules which enter into the structure of the internal layer. These granules, he says, are remarkable not only from their number, but on account of their light yellow hue. Therefore, as after the folding of the internal tunic, they are both very numerous and very compactly bestowed,

the yellow tinge, which is very light for each taken separately, becomes deep for the entire mass.

The two opinions may therefore be recapitulated thus: 1. Effusion of a coagulable fluid, which is blood, according to M. Raciborsky, and plastic lymph, according to M. Coste. 2. Folding, and progressive hypertrophy of the wall of the vesicle. 3. Yellow coloration of the latter, either by the coloring matter of the blood (Raciborsky), or by the condensation of the molecular granules (Coste). These two theories, which include nearly all the others, yet differ upon an important point. According to MM. Raciborsky, Pouchet, Dalton, &c., there is at first an effusion of fluid blood, which soon forms a clot of greater or less density; M. Coste, on the contrary, regards this effusion of blood as pathological, or, at most, as an exceptional occurrence.

[Most physiologists now think that after its rupture, the cavity of the Graafian vesicle becomes filled with a plastic secretion sometimes tinged with blood; the formation of a clot being an exceptional occurrence. While this secretion is being formed, the muscular fibres of the stroma retract and compress the wall of the ovisac, which not being retractile, is thrown into folds, as has been said. Some of the cells of the granular membrane which remain adherent to the internal surface of the ovary undergo hypertrophy, and fatty granules are produced which give a yellow color to the tumor. The folds project more and more and finally become adherent. Then, after having remained stationary for a certain time, this corpus luteum becomes atrophied and gives place to a depressed cicatrix. In short, M. Coste's theory would seem to be the true one, whilst the phenomena described by Raciborsky, though real, are exceptional and pathological.]

Whatever be the fate of the ovule after its expulsion, whether it receives, or not, the vivifying influence of the seminal fluid, the remains of the torn capsule always undergo the primary changes described above.

As the formation of corpora lutea always follows the rupture of a Graafian vesicle, and as this rupture is most frequently spontaneous, it is evident that medical jurists have committed an error in regarding their existence in the ovary as a *certain* indication of an anterior fecundation; but some modern physiologists have also been wrong in supposing that the study of the corpora lutea could have no medico-legal importance whatever; for, although the supervention of pregnancy modifies the corpora lutea in no respect at the commencement of their formation, it exercises an incontestable influence upon their ulterior development. M. Coste, who has followed their evolution step by step in the two cases, has derived from his attentive observation sufficient means of distinguishing a corpus luteum succeeding to a pregnancy, from one pertaining to a female who has not conceived.

Not less than a month, says he, is required in a *pregnant woman* for the filling up of the follicle, and the commencement of adhesion between the folds; and forty days, nearly, will have elapsed, before the connections are firmly established. At this time, their assemblage forms a compact and resisting tumor, of nearly an inch in its longest diameter, and five-eighths of an inch in its shortest. Having thus arrived at its maximum, it remains stationary for some time, until toward the end of the third month its period of diminution commences. The tumor is gradually absorbed, loses its

volume, and seems to enter again into the organ upon the surface of which it had been raised; at the same time it becomes more compact, denser, and more shining. In the course of the fourth month it is nearly one-third, and towards the end of the fifth, nearly one-half smaller. From the sixth to the ninth month it will have lost nearly two-thirds of its volume; still, however, it forms after labor a tubercle of not less than five-sixteenths of an inch in diameter. The latter now diminishes with considerable rapidity, but nearly a month is required for its reduction to a small and hard nucleus of indefinite duration. There is nothing absolute, however, in the rate of retrogression of this phenomenon. For, as in some women who died between the sixth and eighth month of their pregnancy, the corpora lutea were found as voluminous as in others at the fourth month, so evident traces of it may sometimes be discovered several months after labor.

When the corpus luteum is produced under other influences than those to which impregnation gives rise, its development, adds M. Coste, is by no means so great, and its rate of diminution is more rapid. Whilst, for example, from five to six months are required for the completion of the chief modifications during pregnancy, the capsules are almost entirely effaced in from twenty-five to thirty days, in women who have not been

Fig. 37.

Represents a corpus luteum derived from a female who died in the sixth month of pregnancy.

impregnated. The phenomena presented at the commencement, in the last case, are the same as in the former, but the vesicles suddenly soften, and are frequently entirely absorbed before the circumvolutions of the internal layer have acquired sufficient development to come in contact, or to contract adhesions. M. Coste has never known the corpora lutea of a non-pregnant female, who had died suddenly, to resemble those observed in the second or third month of pregnancy; they have neither the size nor the density of the latter (Fig. 37). In a word, adds the learned embryologist, a corpus luteum which is as large as the ovary itself, which forms a solid and resisting tumor, exhibiting upon section the capsule of the ruptured vesicle filled with the strongly-adherent internal circumvolutions, must

belong to a pregnant female. If the circumvolutions are but feebly united, having between them a layer of plastic matter which serves as a medium of adhesion, the corpus luteum corresponds to the second month of pregnancy; if, on the contrary, the circumvolutions are blended into a compact mass, preserving at the same time a size similar to the preceding, it may be regarded as derived from a woman who had died toward the end of the third month of gestation.

From this time the mass becomes more and more compact, remains stationary for a while, and then tends to decrease until the end of gestation.

To explain the passage of the ovule into the Fallopian tube, Rouget has shown that a double layer of muscular fibres passes from the lumbar region of the uterus and embraces the whole extent of the tube and fimbriated extremity. By its contraction during sexual intercourse the tube is flexed upon itself and the fimbriated extremity is drawn toward and is applied to the surface of the ovary. While, as has been shown, coitus hastens the rupture of ripe follicles, the fact remains that the ovule may be discharged at any time, before, during, or after the menstrual flow.

A more plausible theory is that the cilia covering the mucous membrane of the fimbriæ directs the current of liquid bathing the ovaries toward the tube, and the ovule is thus made to enter.

In exceptional cases the ovule fails to enter the Fallopian tube, and may be developed within the peritoneal cavity, giving rise to the condition known as *extra-uterine pregnancy.*

"Schroeder has collected from various authors the reports of several cases in which an ovum has been discharged, has found its way into the uterus, and has undergone development, one tube being closed and the corpus luteum existing upon the side on which the tube was impervious. In some instances in which the corpus luteum has been found on the side on which the tube was closed, tubal pregnancy has occurred upon the opposite side. In these cases the ovum must have passed across the uterus." (Flint's Phys., page 873.)

In reviewing the facts whose history we have just traced, we see that towards the age of puberty, the ovary becomes the seat of an active congestion, and, it might be said, of a new vitality; all the living powers of the organ seem to be concentrated upon one of the Graafian vesicles, which suddenly assumes a considerable development, and in so doing, raises the envelope of the ovary, and forms a tumor, which is superadded to the organ. The walls of the vesicle become weaker and weaker as their distention increases, until they finally give way; in consequence of the rupture, the ovule is expelled and carries with it a portion of the granular fluid with which it was surrounded. This expulsion constitutes the phenomenon known of latter time as *spontaneous ovulation.* The void left in the vesicle is soon filled with blood and a gelatinous matter, which is secreted by the walls of the follicle; the latter becomes hypertrophied and thrown into folds by the retraction of the external tunic, and soon constitutes the corpus luteum.

As accessory phenomena, it is known that the uterus and its annexes participate to a greater or less degree in the ovarian activity, and we have briefly described the peculiarities which they present during the accomplishment of the process; we shall have occasion to return to it in future. Our attention should, however, be first directed to the great resemblance between

this succession of physiological acts, and the series of phenomena which comparative physiology and anatomy have shown to take place in mammalia at the rutting season. In them likewise, the approach of the male is not necessary to the discharge of the ovule, and the spontaneous ovulation is accompanied with almost identical changes in the genital organs, and manifests its influence upon the entire organism by the same assemblage of phenomena. In the human female, as in the mammalia and birds, the spontaneous ovulation, accompanied with the same cortége of symptoms, occurs at more or less regular intervals. In the rabbit, it is the tumefaction and almost varicose injection of the vessels of the vulva. To this coloring and tumefaction is added, in the bitch, an odorous secretion, which allures the males, and puts them upon the track of the females. Finally, in monkeys, a more or less abundant hemorrhage occurs, which, in the case of the macaquæ and the cynocephalæ, coincides with so monstrous a swelling of the vulva, that, in certain cases, the surrounding parts are infiltrated as though inflamed in consequence of the sting of bees. We shall study hereafter the peculiarities of these returns in the human species.

The vesicular evolution, accompanied with the array of phenomena just described, is reproduced at intervals which vary for different animals, but in the human female recurs at much shorter periods. Every month, in fact, in the normal condition, a new Graafian vesicle is found to increase in size, to become excessively distended, and finally bursting and discharging the ovule, to become the seat of the successive transformations presented by the corpus luteum. Every month, therefore, this curious phenomenon of spontaneous ovulation is renewed; and the dark-colored cicatricules of various form, which are observed upon the surface of the ovary of nubile women, give rise to the supposition exclusive of direct observation, that the operation of which they are the consequence must have recurred a great number of times.

Of the phenomena which we have just described, the flow of blood had, until of late years, chiefly claimed attention. This flow, as well as the vesicular evolution of which it is the consequence, occurs for the first time between the ages of twelve and fifteen years, and is afterward periodically renewed every month until the time of life at which the female loses her aptitude for fecundation, that is to say, until she attains the age of from forty-five to fifty years. Known under the names of the *monthly sickness*, the *monthlies*, *courses*, &c., this periodical excretion constitutes *menstruation;* a phenomenon which, though doubtless of importance, is nevertheless far from being the capital fact amongst those which we have studied, for it may be absent, without the vesicular changes being notably affected thereby, whilst, on the other hand, it never appears without having been preceded and accompanied by the development of a Graafian vesicle. It is therefore a secondary phenomenon intimately connected with those which are accomplished in the ovary. The details into which we are about to enter, in reference to menstruation, will complete the history of the ovarian follicles

ARTICLE II.

OF MENSTRUATION.

Menstruation is, as we have said, a periodical flow of blood from the genital parts, having its source in the walls of the uterus. Its first appearance, which is always determined by the ovarian evolution of which it is one of the epiphenomena, reveals the aptitude of the female for fecundation, and constitutes one of the earliest signs of puberty or nubility; I say one of the earliest signs, for it very rarely occurs suddenly, and without having been preceded by precursory phenomena.

These phenomena are both local and general. The first, which are purely physical, occur more especially in the generative organs. Thus, the pubic region becomes covered with hair; the pelvis, which hitherto differed but slightly from that of the male, increases in size in every direction, and gradually assumes the shape which we have indicated as peculiar to the well-formed woman; the breasts are rapidly developed, and the nipple is more projecting, turgescent, and sensitive; the skin which surrounds the latter is also of a darker color than before. The outlines of the body at the same time become rounded, in consequence of the greater abundance and more harmonious distribution of the cellulo-fatty tissue.

These physical changes are rarely found unconnected with an alteration in the moral state of the young girl. Her voice assumes a softer tone, her looks are more timid, and often embarrassed in the presence of persons with whom but a few months previously she had sported as a child. She experiences desires, which are the vague expressions of the development of the senses, which she cannot yet understand. A melancholy sadness, and a taste for solitary places congenial to reverie, replace the boisterous pleasures of childhood.

The congestion which precedes the hemorrhage is indicated by new symptoms. The young girl complains of lassitude, of a sensation of swelling and tension in the lower part of the abdomen, of lumbar and sacral pains, of weight in the loins, of heat in the hypogastrium and peritoneum, of a slight itching and tumefaction in the genital parts, and a painful swelling of the breasts. In many cases, the excitement of the genital organs is so great as to produce a violent general reaction; and, according to Boerhaave, the first appearance of the menses is accompanied with fever. Strange nervous disturbances not unfrequently occur, and I have sometimes observed attacks of genuine hysteria. These symptoms may last from one to eight days, and are followed by a more or less abundant flow of mucus; in the course of a few days, this becomes mixed with a little blood, and soon gives place to a flow of almost pure blood. The hemorrhage continues for several days; then, as the amount of blood mingled with the vaginal mucosities diminishes, the flow becomes less colored, and after resuming the characters of the vaginal secretions, ceases entirely.

Quite frequently, the first menstruation takes place without having been preceded by any of these discomforts. Sometimes the eruption of blood occurs whilst playing or dancing, and sometimes during sleep.

In most young girls the eruption returns after the lapse of a month, and

follows subsequently its regular periodical course; frequently, however, it is not until after three or four periods, and sometimes even later, that the courses become regular. In other cases, again, a long interval elapses between the two first menstruations: thus, M. Raciborsky, having noticed the time between the two first menstrual periods in eighty-seven females, found that in all but fifty-eight, more than a month elapsed between them. In two women, the second menstruation occurred six weeks after the first; in four, two months; in five, three months; in four, four months; in one, five months; in one, eight months; in three, a year; finally, in one, two years.

These irregularities in the return of the second period may, doubtless, be due to a morbid condition requiring treatment, but they may also depend upon an atony of the genital organs, which does not allow the physiological development of the Graafian vesicles to continue. This temporary atony does not interfere with the general health of the female, nor prevent the future performance of the function; it often disappears under the excitement produced by a change of life, or by the first conjugal approaches. (Raciborsky.)

In some young girls, the functional troubles and abdominal pains, which we have regarded as so many precursory phenomena of the first appearance of the menses, may not be followed by the flow of blood, and, after having lasted for several days, they diminish and cease entirely; they may recur thus every month, for a certain time, with no other result than a momentary disturbance of the general health, and it is only, so to speak, after several fruitless attempts, that the courses become established in a complete and regular manner.

The symptoms which heralded the first menstrual flow do not usually recur at the subsequent periods, or, at least, they continue to diminish with each monthly return. In some females, however, they always appear with their original intensity, and I have often remarked, in reference to these cases, that the acute pains and colics which prelude the flow of blood, disappear, or even cease entirely, immediately after the first conjugal approaches, and especially after the first labor. In a still greater number, the return of the menstrual period is throughout life indicated by some slight pains, a little uneasiness, or merely by a more or less marked disturbance of the general condition; the temper is less even, the woman becomes more excitable, more irascible, in a word, less amiable.

The time at which the first appearance of the menses occurs varies exceedingly from the influence of climate, habits of life, and constitution. The following table, extracted from the work of Müller, with notes by Jourdan, gives an idea of these variations in different countries.

AGE	Paris, Brierre.	Lyons, Bouchacourt.	Marseilles, Marc d'Espine.	Manchester, Robertson.	Göttingen, Osiander.	Paris, Raciborski.	Paris, Raciborsky.	Norway, Faye.	Varsovia, Lebrun.
5 years, . .	1								
7 " .	1								
8 " . .	2								
9 " . .	11						1		
10 " . .	29	5					7		
11 " . .	96	14	6	10		4	18		
12 " . .	129	26	10	19	3	10	34	4	
13 " . .	138	47	13	53	8	20	40	4	
14 " . .	212	50	9	85	21	29	55	13	1
15 " . .	204	76	16	97	32	38	77	14	15
16 " . .	140	79	8	76	24	41	81	20	27
17 " . .	133	58	4	57	11	20	72	13	35
18 " . .	95	38	2	26	18	20	35	13	13
19 " . .	43	21		23	10	12	26	6	6
20 " . .	33	9		4	8		24	8	2
21 " . .	8	5			1	4	14	3	1
22 " . .	8	1					2		
23 " . .	4				1				
24 " .		5				2		1	
25 " . .							1	1	
Total, . .	1285	342	68	450	137	200	487	100	100

According to this table, the greater number of first menstruations occur, at Paris, between the ages of fourteen and fifteen years; but it may be remarked, that the most common variations fall between the ages of eleven or twelve, and seventeen or eighteen years.

Warm climates, a residence in cities and the habits which are contracted there, together with robust constitutions, seem to favor the precocious development of puberty; a low temperature, residence in the country, a feeble and delicate constitution, appear, on the other hand, to retard the appearance of the menses.

Numerous exceptions to the averages above indicated are mentioned by authors. Thus, as examples of tardy and precocious menstruation, we see by the table that five women menstruated for the first time at the age of twenty-three years, six at twenty-four, and two at twenty-five. In some very rare instances, the first appearance has been delayed for a much longer time; thus, M. Kleeman mentions the case of a woman who was married at the age of twenty-seven years, and who did not menstruate until two months after her eighth confinement; she then continued regular until the age of fifty-four years. Pecklin speaks of a strong and healthy married woman, who had never menstruated, although she was forty years of age; her courses made their appearance upon one of the first nights succeeding her second marriage, and recurred regularly for two years, at the expiration of which time she became pregnant.

If we compare these cases of tardy menstruation with the numerous instances of women who become mothers without ever having menstruated, and of nurses in whom the suppression of the menses did not prevent con-

ception, we shall find a full confirmation of what was stated in the preceding chapter, in relation to the secondary importance of the menstrual discharge. Regarded as a phenomenon attendant upon the changes going on in the ovary, it may be absent even though the Graafian vesicle should undergo all its phases of development; nor can its absence be now considered as indicative of the impossibility of fecundation.

We cannot accept all the observations of very precocious menstruation; but, laying aside the numerous cases in which the nature of the discharge has not been so well determined as to allow of their reception without questioning, there are some whose genuineness is undoubted, inasmuch as the appearance of the discharge was attended with all the attributes of puberty. Thus, Dr. Susewind knew of a child of seventeen months, which had menstruated since she was a year old; the hemorrhage returned regularly every month, and the breasts and mons veneris were those of a girl of fourteen or fifteen years of age. The child observed by Lenhossek menstruated when nine months old, and at two years she presented all the external signs of puberty. The girl mentioned by D'Outrepont, who had four teeth when two weeks old, was regular from the age of nine months; she had at that time long black hair and prominent breasts. A woman observed by Carus, menstruated when two years old, became pregnant at eight, and died at an advanced age.

In a memoir by M. Dezeimeris, many other similar facts, derived from Schœfer, Louis Robert, Le Beau, Descuret, Comarmond, Clarke, Lobstein, &c., &c., are recorded.

These premature menstruations are certainly due to the same causes which determine their appearance in most women about the age of fifteen years. Being always accompanied by the development of the breasts and the other marks of puberty, they are the evidence, that under the influence of an anomalous vitality of the ovaries, the Graafian vesicles have undergone a very precocious development.

When once well established, the menses assume their regular periodicity, which is generally preserved up to the time of their cessation, without other interruption than that which is occasioned by nursing or pregnancy. They return about every month, as their name indicates; yet the interval between them is far from being the same for every female. The average of the catamenial period is stated by Roser and Wunderlich at twenty-eight days; in a large number, according to Brierre de Boismont, it is thirty days; and in some instances the intermenstrual period is longer than thirty days, extending to five or six weeks, and sometimes even to two months. In some women the returns occur upon the same day of each month; in a much greater number, the end of the solar month is anticipated by two, three, four, or five days. Sometimes the period is much shorter, the returns occurring at an interval of twenty-four, twenty-two, twenty, and even fifteen days.

These frequent variations in the duration and return of the catamenial period are a refutation in advance of the opinion of those authors who think that all women menstruate generally at the same periods, and that there are times in each month when no one is unwell; it is evident that the retardations or the anticipations of which we have spoken, must have the

effect of bringing the return of some female upon every day of the year. The flow also commences almost indifferently, during the day or night.

The periodicity of the catamenia generally continues until the age of from forty to fifty years, at which time they usually cease. We shall hereafter treat of the peculiarities which often attend their cessation.

The *duration of the flow* varies between one and eight days; according to Brierre, it most commonly lasts for eight days; and next in order of frequency, we have three, four, two, five, one, six, ten, and seven days. Many observers have noted three or four days, as expressing the most usual duration. In some very exceptional cases, it lasts for a few hours only; in others quite as rare, apart from pathological conditions, it is prolonged through twelve or fifteen days.

The *quantity of blood* lost is variable for the same woman, and especially so when observed in different individuals; we may here add, that it is very difficult in any case to estimate it exactly. If the *two cotyles* of Hippocrates be eighteen ounces (550 grammes), as translated by Galen, his estimate (provided Galen's rendering is correct) is evidently exaggerated, at least for our time and climate. If we appreciate the amount of blood lost by the quantity of stained linen, I think the estimate of Haen, who set it down as averaging from three to five ounces, will be found to come nearest the truth.

The quantity of the discharge appears to be greatly influenced by the diet, habits of life, and climate; it is greater with rich and indolent females who use a succulent diet, than with those who are placed in an opposite condition. According to most authors, very warm climates exert a marked influence upon it, and, for my own part, I am acquainted with several ladies who menstruate much more abundantly in summer than in winter.

It is said that women from the country, who become domestics in Paris, soon find their courses to diminish, and sometimes even cease entirely. Such may be the case with many of them, but it is due chiefly to the influence upon their constitutions of the want of fresh air, exposure to the sun, and of the exercise to which they had been accustomed from childhood, rather than to any change in their diet; for, in general, the nourishment which they receive from their employers is much better than that with which they were obliged to content themselves in their own families.

The amount of the discharge is not the same throughout the duration of the menstrual period; ordinarily, it flows moderately on the first and second days, increases on the third and fourth, and then gradually declines. Neither is the discharge always continuous; it sometimes diminishes and even stops entirely for several hours, sometimes for one or two days, and afterwards reappears either spontaneously or under the influence of a walk or a ride. Moral emotions, sometimes the process of digestion, and, above all, the action of cold, may determine its momentary or final diminution or suppression.

The *seat of the hemorrhage and the nature and qualities* of the menstrual blood, have been the subject of very different opinions. What we have already said, whilst describing the changes in the uterine mucous membrane, during the ovarian evolution, leaves no doubt as to the source of the

menstrual fluid. It exudes, manifestly, through microscopic fissures on the internal surface of the mucous membrane of the uterus. This fact, which is placed beyond a doubt by numerous autopsies of women who died during menstruation, had been already proved by the accumulation of blood in the cavity of the womb, where the neck was imperforate, and by the touch, and the speculum, whereby it has been both felt, and seen to flow from the orifice of the uterus.

Certain facts have been adduced in order to prove that, in some cases, the menstrual blood proceeds from the vagina. I think that the greater number of these observations have been either badly made, or wrongly interpreted. I do not deny the possibility of exhalations of blood from the walls of the vagina; but if they present the periodicity of the menses, they can be regarded in no other light than as a misplacement of the latter. The fact related in the note below appears to me to possess great interest in reference to this subject.[1]

[1] I have recently (November, 1849) seen, in connection with my excellent confrère, Dr. Thirial, a young girl, twenty-one years of age, who had menstruated only twice and for three days at a time; and in whose case the hemorrhage must of necessity have had its origin in the mucous membrane of the vagina.

This young girl, who had been for a long time violently in love with an officer, finally yielded herself completely to his wishes. After several attempts, renewed with much ardor, but which each time proved fruitless, the young man finally discovered, and acquainted her with the fact, that she was not formed like other women, and advised her to consult a physician. She applied first to M. Thirial, who solicited my opinion. A very careful examination enabled me to ascertain as follows:

The countenance, stature, and development of the limbs and breasts, differed in no respect from what is usual in young girls at her age. Her general health had always been good. In the month of May last, her courses appeared for the first time, and continued three days; she had, however, for several years before, experienced symptoms of uterine congestion. In the month of July, they showed themselves again for the last time. The attempts of her lover were twice followed by a considerable flow of blood, which lasted two days, but she attributed it much rather to the amorous violence to which she had been subjected than to a periodic return of the menses.

The mons veneris is completely destitute of the hair with which it is usually covered. Upon the lateral and inferior regions, immediately above the external orifice of the inguinal canal, a tumor is observed on each side which elevates the integuments. The tumor has the size, form, and consistence of an ovary or testicle; it is but slightly painful; under a very moderate pressure it retreats through the inguinal canal, and disappears in the abdomen, but as soon as the pressure is removed from the internal orifice of the canal, it reappears, sometimes spontaneously, sometimes on the slightest movements, or the least effort of coughing or respiration. On no occasion was I able to perceive the signs which ordinarily accompany the reduction of an intestinal or epiploic hernia.

The vulvar opening was bounded by the greater and the lesser labia, but both were much less developed than usual. The finger, which could be introduced only with difficulty into the vulvar orifice, was arrested at a depth of three-quarters of an inch, so that it was only by forcing up the extremity of the vagina, that the first phalanx could be made to enter that canal.

Upon introducing the extremity of a speculum, it was impossible to discover any opening, or any point which would afford passage to the end of a stylet. I was able to ascertain, at the same time, that the membrane pressed upon by the extremity of the speculum, possessed all the rugæ, and other characters of the vaginal mucous membrane.

As we have already said, the menstrual blood, which is at first small in quantity, becomes mixed with the mucosities which are secreted abundantly by the vagina for a day or two preceding the appearance of the catamenia. The amount of blood soon increases, and the flow becomes almost exclusively sanguineous.

It is very difficult to say whether the blood is furnished by the arteries or veins, or by both together. In all probability, the blood exudes through the walls of the very delicate ramuscules which form the vascular network of the innermost layer of the uterine mucous membrane. The walls of the capillaries are ruptured, and through this solution of continuity the blood escapes. It is not, therefore, a true exhalation.

Now, when gestation has progressed to some extent, these ramuscules become so greatly developed that many of them acquire the calibre of a quill. At this time their true nature may be ascertained, and the fact settled, that they belong to the venous system; so that the menstrual hemorrhage which they supply must evidently have its source, in great part at least, in the reservoir of dark blood.

The physical characters of the menstrual blood vary according to the time at which it is examined, since it is mixed at the beginning, at the middle, and at the end of the flow, with different amounts of vaginal mucus.

The portion which escapes during the second period, not only resembles completely in external characters that which is obtained directly from a vein or an artery, but is shown to be identical by chemical analysis. Its slight coagulability has been regarded as an evidence of a want of fibrine; but, though it coagulates rarely, as a general fact, yet there are occasions in which clots exist in the vagina, and in the cavity of the uterus itself.[1] The presence of fibrine has been chemically demonstrated, so that though the coagulation of the menstrual blood be of rare occurrence, the fact is certainly due to its being uniformly mixed with a considerable amount of vaginal mucus.

On examination by the rectum, I found: 1. That the rectal pouch, or dilatation, was much larger than in the normal condition; 2. That above the extremity of the vagina, when pressed upward by my thumb, the index introduced at the same time by the anus and carried as high as possible, could discover neither fibrous cord nor tumor; nothing, in fact, which could lead to a belief of the existence of the upper part of the vagina and of a uterus; 3. Having introduced a sound into the bladder, the finger in the rectum perceived with the greatest ease that nothing intervened between its palmar surface and the vesical sound, except the normal thickness of the two walls of the rectum and bladder. The sensation was identical with that experienced when the index is introduced into the vagina in order to direct a sound in the urethra.

From this examination I thought myself justified in concluding: 1, that the tumors found in the inguinal regions were the two ovaries; 2, that the lowest extremity only of the vagina was present; 3, that the upper four-fifths of that canal were completely wanting; 4, that, most probably, there was no uterus; 5, that the hypogastric and lumbar pains which were experienced quite regularly, and almost monthly, were the expression of periodical ovarian operations; 6, that the blood of the menses which had appeared twice in this young woman, had its origin in the mucous membrane of the vagina.

[1] It is, however, right to observe, that the presence of clots in the menstrual discharge is frequently due to an alteration of the structure of the uterus, or, at the least, to a functional derangement.

The eruption of the menses is generally attended with a peculiar odor proceeding at that time from the secretions of the vulva; it increases in intensity during the flow, and has been compared by some persons to the smell of the marigold. Can it be that the strange fears with which menstruating women are regarded in some countries, are attributable to this odor, which in uncleanly individuals is very strong? Although this is probable, I should think it futile to discuss the incredible stories upon which are based the popular notions of the noxious properties of the menstrual emanations.

Certain females discharge by the vulva, at the menstrual period, a kind of membranous bag, which would seem by its form to have been moulded upon the uterine cavity, and which bears a strong resemblance to the membranous pouch (*deciduous membrane*) which is expelled with the ovum in some cases of abortion. The nature of the pouch is, in fact, the same in both cases, being formed of cellular tissue, which is both vascular and glandular; its internal surface is always smooth, provided with epithelium, and often abundantly perforated with glandular orifices. The external surface, by which it adhered to the organ from which it was separated, is shaggy and torn. It is evidently an exfoliated portion of the mucous membrane.

This exfoliation usually occurs in such women only as are afflicted with difficult or very profuse menstruation, accompanied with violent pain (*membranous dysmenorrhœa*), or in such as experience a delay in the appearance of their courses. According to M. Coste, this phenomenon is the result of an excessive congestion, a sort of apoplexy of the mucous membrane; for, says he, coagula are almost always found infiltrated in the substance of the expelled membrane. I would add as probable, that, in some cases at least, this exaggerated congestion may have been the consequence of an abortive conception, or perhaps of solitary venereal excitements.

Those physiologists were mistaken who supposed that at every menstrual period a free secretion took place upon the internal surface of the uterus, and gave rise to a false membrane. Nothing of the kind has ever been proved by anatomical investigation; for the internal surface of the uterus, at whatever moment examined during the catamenial period, always retains the characters peculiar to the mucous membrane, remaining smooth, and covered with epithelium. Sometimes, however, the latter exfoliates, and bears away with it a portion of the substance of the mucous membrane, in which case, the torn glandular tubes rendered free and floating by the separation, form, as it were, a forest of white filaments, and give accidentally to the internal surface of the uterus the villous and shaggy appearance which some authors have erroneously considered as normal. This circumstance is, however, altogether exceptional, and results from the membranous exfoliation of which we have just spoken.

Cause of Menstruation.—Few questions have given rise to more lively discussions than the cause of menstruation; I think it useless, however, to mention here the numerous and more or less whimsical hypotheses which have successively appeared in reference to it. The fact is, that after having read all that has been written on this subject, the mind rests entirely

satisfied in its ability to refer this singular phenomenon to one unchangeable and easily verified fact, namely, *the successive evolution of the Graafian vesicles.* We owe this satisfactory explanation to the admirable labors of Négrier, Coste, Pouchet, Raciborsky, Robert Lee, and Bischoff, so that the credit of so beautiful a discovery belongs almost exclusively to France.

That *the cause of the menstrual discharge is the evolution of a Graafian vesicle,* would be an indisputable proposition, provided we are able to show: 1, that the examination of women who died during or shortly after the menstrual period, has uniformly revealed the above-named changes in the ovary; 2, that the absence of ovaries involved of necessity the absence of menstruation; 3, and lastly, that there is a complete analogy between the anatomical and physiological phenomena of the heat of animals, and those which accompany menstruation in the human female.

1. Since attention has been directed to this subject, no one has succeeded in instancing the case of a single woman, who died at the menstrual period, whose ovary did not present a vesicle in a greater or less degree of development, or else one which had been already ruptured. The facts related by Coste, Négrier, Pouchet, Raciborsky, and others, are now so numerous, that it would be impossible to reproduce them in a work like the present. I might myself add, if it were necessary, a considerable number of cases to the others. This universal coincidence affords from the outset a very strong probability of the relation of causality which we wish to establish; but it would become an absolute certainty, were it possible to prove that the absence of the ovaries involved of necessity the absence of the menses.

2. In the case of animals, on which the experiment can be repeated at pleasure, not a doubt is permitted, that the extirpation of the ovaries causes the disappearance, forever, of all symptoms of heat. Analogy alone would lead us, in the absence of positive facts, to suppose that menstruation, also, would cease after castration. But although well-observed instances of the performance of this operation on women are happily very rare, there is yet one which derives a great value in the present discussion from the name of the author. The following is an abridgment of it. A woman, says Percival Pott, had two small tumors, one in each groin, which were so painful as to render working impossible. It was decided to extirpate them. After having divided the skin and the subcutaneous tissues, a membranous sac was exposed, which contained a body resembling an ovary; a ligature was thrown around it, and it was removed. The same operation was performed on the opposite side. The woman recovered; *but the menstruation, which before had occurred with the greatest regularity, never afterwards appeared;* the breasts, which had been voluminous, subsided; she also became thinner, and assumed a more masculine appearance.

From the statement of M. Roberts it would appear that in Central Asia, vestiges are still to be met with of the cruelty of the ancient kings of Lydia, who castrated women, either that they might put them in charge of their seraglios, or in order to gratify their unbridled passions. After arriving at Séraï, he obtained a nocturnal rendezvous with three persons known as *Padjeras.* The necks of these individuals were not developed, nor had they any nipple; the orifice of the vagina which was entirely obliterated, presented

no trace of a cicatrix; their hips were narrow, the pubis entirely destitute of hair, the nates were flattened, &c.; they had no hemorrhoidal flux, no epistaxis nor menstrual discharge, neither had they any sexual desires. They were very muscular, and there was something masculine both in their external appearance and in the character of the voice.

M. Roberts was unable to ascertain precisely the nature of the operation to which they had been subjected in their childhood, for they had no remembrance of it; but if we may judge by the results, which are altogether similar to those produced by castration in animals, it becomes more than probable that the same alterations are due to the same cause.

3. Admitting, finally, the incontestable analogy between the symptoms of heat and menstruation, it will be sufficient to prove, in order to deduce therefrom a favorable argument, that the former is always connected in animals with the ovarian evolution. Now certain experiments do not allow of hesitation. By these it is in fact proved (Coste), that the females never enter into heat except when the preparation for the spontaneous ovulation is going on in the ovaries, that the venereal erethism continues throughout the entire duration of the process of evolution, and that it ceases when the rupture of the capsule has taken place. Finally, it is universally known that castration prevents the females from entering into heat, whilst those which have been deprived of the womb, but not of the ovaries, lose nothing of the ardor with which they receive the male.

Menstruation is, therefore, intimately connected with the evolution of the ovarian vesicles, and cannot occur without it; and every time that it appears, we may feel entirely satisfied as to the existence of the vesicular development. But, as an additional phenomenon, the uterine hemorrhage may be wanting without hindering, in any degree, the regular march of the process going on in the ovary. In a word, the spontaneous ovulation which ordinarily gives rise to an exhalation of blood from the internal surface of the womb, may have its influence restricted to the ovary alone; and to assume the non-appearance of the menses as a ground for denying aptitude for conception, would be incurring the risk of frequent deceptions. Thus it happened that science possesses numerous examples of young girls who became pregnant before they had ever menstruated, as also of women who conceived, notwithstanding a suppression which had lasted for several months.

On the other hand, the regularity of the menstrual function does not necessarily imply the entire fulfilment of the vesicular evolution. In certain cases, the latter process has been seen to remain incomplete, and the vesicle after having attained a certain degree of hypertrophy, to be suddenly arrested in its development, to remain stationary for some time, and then abort without rupture. I have chanced to meet, says M. Coste, cases in which the menstrual flow had passed over entirely, without the ovarian follicle, whose evolution had commenced and even progressed to its final period, having ruptured, or accomplished the result toward which it tended.

The cause of menstruation being ascertained, how shall we account for its monthly periodicity? In other words, why is it that ovulation in the human species recurs about every month? To this question science is unable to reply, for it is probably one of the impenetrable mysteries of nature.

But why should our ignorance upon the subject be a cause of wonder? Do we know why certain trees produce new flowers every month? why this animal is prepared for fecundation every two or three months, whilst that one is so but once a year? The processes which we have studied are intimately connected with fecundation, and are, so to speak, its preludes. Why, when the whole book is unintelligible to us, should we expect to comprehend the preface?

Cessation of the Menses.—As we have before said, the menses continue in the majority of women until about the age of 45 years. According to a table of Brierre de Boismont, 40 years is the age at which the greater number of women cease to be regular. In 60 women observed by M. Pétrequin, it was between 35 and 40 years in $\frac{1}{8}$, between 40 and 45 in $\frac{1}{4}$, between 45 and 50 in $\frac{1}{2}$, and between 50 and 55 in $\frac{1}{8}$. In 110 women mentioned by M. Raciborsky, the average age of cessation was 46 years. The latter author cites from Dr. Lebrun of Varsovia, and Faye of Skeen, results which go to prove that in Poland the average term is 47 years, and in the neighborhood of Christiana 48; all which tends to show that in cold climates menstruation terminates later in life. It may be admitted, therefore, that the average duration of the menstrual function is from 25 to 30 years.

But like their commencement, the period at which the menses cease is subject to great variation. Desmoreaux mentions a lady with whom they stopped at 23 years of age; nor is it rare to find them suppressed between 35 and 40. On the other hand, they are often prolonged much beyond the ordinary period, and with them, the women retain the power of conception up to 60, 65, and even, as some authors relate, to 70 years. I leave to the lovers of the marvellous those instances in which menstruation continued until 80, 90, and even 106 years. It is infinitely probable that, in the cases of this nature, the pretended menstrual returns were really due, as Haller remarks, to uterine disease. I would add, that we should place in the same category those examples of women who, after having ceased to menstruate about the age of 45 or 50 years, have had their courses to reappear several years after, and continue with regularity.

According to most authors, those women who menstruate very early also cease to do so sooner than others. This remark appears, both to M. Raciborsky and myself, to be inexact, when not applied to individuals living under different climates. With the former author, we think that precocious menstruation is due to an excess of vital power in the individual, and that, exceptional circumstances excluded, the influence of this vital activity is felt later in life, and prolongs the aptitude for procreation in the woman. So that, in general, it ceases as much later as it begins at an earlier age.

The cessation of the menses, and of the vesicular evolution of which they are an epiphenomenon, produces in the generative apparatus and entire organism of the woman, effects the opposite of those which their first appearance had determined.

The *ovaries* become atrophied, and diminish in size in every direction, and their external envelope becomes folded and wrinkled, so as to present an appearance which, says M. Raciborsky, we can compare to nothing better than the surface of a peach-stone.

The *Graafian vesicles* appear as pouches of a grayish or opaque white color, with wrinkled walls; the fluid which they contained is absorbed; sometimes their cavities are effaced, their thickened walls are in contact, and look like a sort of tubercle, in the centre of which barely a trace of the former cavity is visible. Sometimes no part of the vesicles can be discovered, and the ovary, which has become transformed into a fibro-cellular substance, is so flattened as to be hardly distinguishable at the extremity of its ligament. We have already spoken of the deep folds and wrinkles of its external membrane.

Finally, the womb and the breasts, whose vitality became suddenly so active towards the age of puberty, seem struck with the same blow which destroyed the ovarian orgasm; they waste gradually away, and become, so to speak, foreign to the general life of the body.

This cessation of the ovarian functions rarely takes place suddenly, but is almost always announced several years in advance by more or less marked irregularities or intermissions. Frequently, the returns of the menses suffer postponements, which may be prolonged for several weeks or months, and then, after renewal, be deferred for a still longer period. Sometimes the epochs are marked by a very small discharge, and last for a very short time; again, on the contrary, the quantity of blood lost may be so considerable as to give rise to apprehension. With certain women the flow is so excessively prolonged that the menstrual periods are only indicated by its increase; a mucous flux of a yellowish-white color, which is quite abundant, and either continuous or periodic, replaces the flow of blood in the interval of the epochs, and sometimes remains for a long time after they have ceased. Finally, a general and indefinite feeling of uneasiness, lumbar and pelvic pains, colics, itching at the genital parts, flashes of heat in the face, and sudden and spontaneous alterations of chilliness with profuse perspirations, are added to the local phenomena above indicated.

In the majority of cases, all these troubles are quite slight and disappear promptly; but, in some instances, diseases before latent then declare themselves. It is this fact which, though much rarer than is commonly supposed, has obtained for this time of life the name of the *critical period*. Its dangers have been wonderfully exaggerated, and modern researches prove, in opposition to the opinion of physicians who have preceded us, that the organic affections of the breasts, of the uterus, and of the ovaries, begin much more frequently before than after the cessation of the menses. Finally, it is shown by statistics, that the mortality in women between the ages of 40 and 50 years is not greater than at any other period of life.

CHAPTER V.

OF THE BREASTS.

[THE breasts, two in number, are large glands, annexes, so to speak, of the organs of generation. They are symmetrically placed on the upper and anterior part of the thorax on each side of the sternum, generally occupying the space included between the third and fifth ribs. Rudimentary in man and in the young girl, they become developed in the latter at the period of puberty. They present great individual difference in size, but in the women of certain races they are generally very large, some African nations, for example, having them extremely long.

The left breast is often larger than the right one. Curious anomalies, also, sometimes come under observation. Thus, women are reported having four breasts, and I have myself met with an instance of this kind in a woman who died at the Maternity Hospital. Two breasts of the usual size occupied their normal position, whilst two others, as fully developed, were situated on the upper and lateral parts of the abdomen on the same vertical line with the thoracic ones. At the autopsy, I found abundance of glandular tissue in all four of the breasts, which also contained milk.

A supplementary nipple at a short distance from the principal one, is a more frequent anomaly, of which I have already seen several examples. A wax model from a cast of one of these is now in the collection of the hospital of the "Clinique." In the instances which have come under my observation, the supplementary nipple was well formed, but smaller than the normal one, and milk flowed from it when the gland was pressed. One of the women assured me that the peculiarity was hereditary in her family.

The natural form of the breast is hemispherical, or rather represents a flattened cone with the base upon the chest. The skin covering it presents in its centre a projection known as the nipple. Around the nipple is a colored circle, from an inch and a quarter to rather more than an inch and a half in diameter, called the areola, and is easily distinguished by its contrasted hue. Some further remarks will be necessary to the proper study of all these parts.

The skin covering the breasts is fine and soft, and is provided with piliferous follicles to which are connected large sebaceous glands. The hairs are extremely fine and readily seen only when magnified. Beneath the skin, and between it and the gland proper, is a layer of cellulo-adipose tissue, which increases in thickness in approaching the circumference of the organ. To this fatty layer the breasts owe their regularly rounded form, their softness, and very often the greater part of their size.

The areola is rose-colored in young women, and brown in those who have borne children. The skin covering it is rugous, abundantly furnished with sebaceous glands, and exhibits here and there tuberculous elevations of variable size. These projections, numbering from twelve to twenty, have a somewhat circular arrangement, and are composed of collections of highly developed sebaceous glands which secrete a yellowish-white fluid. The character of the secretion was doubtless the cause of their having been so long regarded as rudimentary nipples giving issue to drops of milk. This erroneous view can no longer be maintained since they are proved to be sebaceous glands.

The areola does not rest upon a fatty cushion like the remainder of the skin of the breast, but is in direct relation with the gland; its lower surface, however, is provided with a layer of smooth muscular fibres disposed around the nipple in close concentric circles, which become more widely separated toward the edge of the

areola where they finally disappear. The skin-muscle thus formed compresses the nipple when it contracts. Under its action also, the skin of the areola contracts and wrinkles if the nipple be excited by tickling.

The nipple, situated in the centre of the areola, presents a slightly conical projection, from three to five eighths of an inch in height and from five-sixteenths to three-eighths of an inch in diameter at the base. These dimensions, however, as well as the shape of the nipple, vary greatly. In some women it is very slightly developed and barely projects at all; in others, it is actually below the surface of the areola, presenting a sort of umbilical depression. On the other hand it may be very large or even club-shaped. The skin covering it presents numerous papillæ, separated by creases in the bottom of which are the orifices of great numbers of sebaceous glands. Beneath the skin are connective tissue, elastic tissue, and bundles of muscular fibres.

This structure explains sufficiently why touching the nipple should, by exciting contraction of the fibres which it contains, render it for the moment harder and more projecting. Still, it must not be confounded with the truly erectile organs, inasmuch as its arteries are small and not contorted and the veins also of small size.

The nipple is traversed from base to summit by lactiferous ducts fifteen or twenty in number, which open by as many minute orifices near the free extremity of the organ at the bottom of the folds between the papillæ.

The mammary gland proper, is situated beneath the parts just described, in a fold of the fascia superficialis. It presents a hard, flattened mass which is thicker at the centre than at the circumference. The glandular structure is disposed in fifteen or twenty lobes, separated by a fibrous envelope surrounded by fatty tissue.

Fig. 38.

Lobules of a mammary gland.
A. Acini.
B. Canaliculi.
C. Duct formed by several canaliculi.

Each lobe is formed by the aggregation of a certain number of lobules, themselves composed of glandular culs-de-sac or acini dilated into terminal vesicles. From each vesicle departs a minute duct which joins those of neighboring acini. The ducts from the lobules unite in their turn to form in each lobe a principal canal which has received the name of lactiferous duct.

As each lobe has its principal or lactiferous duct, the whole number of these vessels is the same, *e. g.* fifteen or twenty, as that of the lobes.

The lactiferous ducts all proceed toward the nipple, but in passing under the areola they exhibit dilatations which have received the name of sinuses. Then entering the nipple, they diminish in size and terminate by separate and very minute openings.

It is most probable that the lactiferous ducts are independent of each other throughout their extent. Prof. Dubois, indeed, expressed the opinion that they often anastomose; but M. Sappey, who has investigated the subject more recently, failed to discover any connection between them.

The fact that the walls of these ducts are provided with muscular fibres is sufficient to explain the spirting out of the milk when they contract.

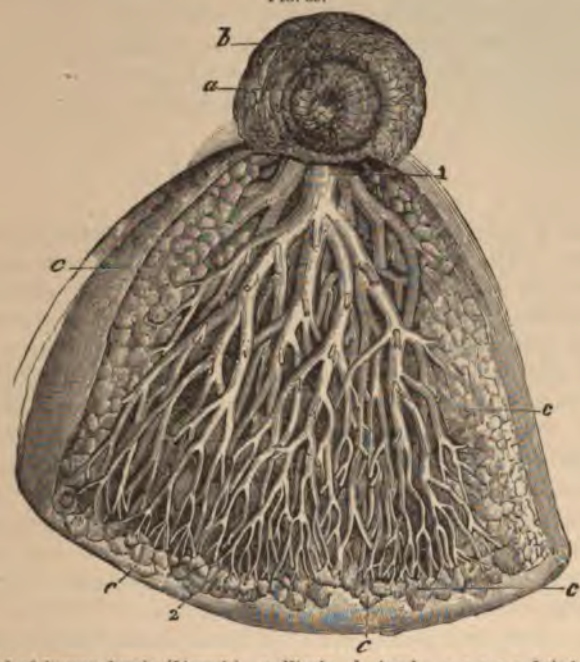
The arteries of the breast come from the external and internal mammary and the intercostal arteries.

The veins follow the same course with the arteries, and empty, some into the internal mammary, and others into the axillary vein.

The lymphatic vessels, which are very abundant, pass into the axillary ganglia.

The nerves come from the intercostal and thoracic branches of the brachial plexus.]

FIG. 39.



Mammary gland of human female (Liegeois). *a*. Nipple. *b*. Areola. *c, c, c, c, c*. Lobules of the gland. 1. Sinus, or dilated portion of one of the lactiferous ducts. 2. Extremities of the lactiferous ducts.

COMPOSITION OF HUMAN MILK.

The following table, from Professor Flint's Physiology, was compiled by Robin from various analyses, and is probably the most trustworthy:

Water		902.717 to	863.149
Caseine (desiccated)		29.000 "	39.000
Lacto-proteine		1.000 "	2.770
Albumen		traces "	0.880
Butter, 25 to 38	Margarine	17.000 "	25.840
	Oleine	7.500 "	11.400
	Butyrine, Caprine, Caproïne, Capriline	0.500 "	0.760
Sugar of milk (lactine, or lactose)		37.000 "	49.000
Lactate of soda (?)		0.420 "	0.450
Chloride of sodium		0.240 "	0.340
Chloride of potassium		1.440 "	1.830
Carbonate of soda		0.053 "	0.056
Carbonate of lime		0.069 "	0.070
Phosphate of lime of the bones		2.310 "	3.440
Phosphate of magnesia		0.420 "	0.640
Phosphate of soda		0.225 "	0.230
Phosphate of iron (?)		0.032 "	0.070
Sulphate of soda		0.074 "	0.075
Sulphate of potassa		traces.	
		1.000.000	1.000.000

Gases in solution	Oxygen	1.29	30 parts per 1.000 in volume. (Hoppe.)
	Nitrogen	12.17	
	Carbonic acid	16.54	

PART II.

OF PREGNANCY.

GENERATION is effected in the human species through the medium of two sexes distinguished by the possession of different organs. The sexual characters being therefore peculiar to distinct individuals, the male and the female, these evidently must first approach each other before generation can take place. This first act constitutes *copulation*. The consequence of the approach is an application of the fecundating principle of the male to the germ furnished by the female, in other words, *conception* or *fecundation*. The ovum having been fecundated, remains, and is developed in the organs of the mother during the whole term of *gestation*. Lastly, at the expiration of a nearly uniform period, the new being is expelled, to maintain thenceforth a separate existence; this final act is termed the *accouchement* or *labor*.

Pregnancy is, therefore, the condition of a woman who has conceived, and bears within her womb the product of conception.

This state commences at the instant of fecundation, and terminates with the expulsion of the body which results from that function. It continues for two hundred and seventy days, or nine solar months. This term, however, is not invariable, as it is by no means rare for the pregnancy to terminate sooner, and in some very few instances we find it of longer duration, though some persons have denied this latter fact, and everybody recalls the sharp discussions carried on in France about the middle of the last century, and still more recently in England, on the question of retarded births.

We have already stated that the fecundated ovule traverses the tube, so as to reach the uterus, where it is developed and continues to grow during the whole term of gestation. When the succession takes place in this manner, the pregnancy is said to be a *good*, *normal*, or *uterine* one; but, on the contrary, if the ovule be arrested at some point of its passage, and is developed elsewhere than in the womb, the pregnancy is denominated *bad*, *extraordinary*, or *extra-uterine*. The first, or uterine pregnancy, has been divided into,—the *simple*, where only a single fœtus exists; the *compound*, or double, triple, &c., where there are two or three children; and the *complicated* pregnancy, or that in which the positive existence of a fœtus is coincident with that of a pathological tumor of the abdomen. Again, the term *false pregnancy* has been improperly applied to certain diseases simulating pregnancy, where this state does not really exist.

We shall first treat of simple pregnancy, leaving the subject of twin pregnancies for a special chapter. Extra-uterine pregnancy will be studied with the other diseases of the pregnant female.

The pregnant condition presents two classes of phenomena, one of which pertains to the woman, and the other to the product of conception they are to be studied separately.

We have already described the genital organs of the female, and it is not our province to notice those of the male. We shall be equally silent upon all that relates to sexual intercourse, though it is our purpose to treat briefly of conception, and in detail of gestation.

CHAPTER I.

OF CONCEPTION.

CONCEPTION takes place during sexual congress; but to understand how it occurs, requires that we should know first what materials are furnished by each individual, how and where these are brought into contact, and lastly, what is not yet, and probably never will be explained, how from this contact a new individual is produced.

1. The spermatic fluid, a glutinous, consistent, and whitish liquid secreted by the testicle, is the fecundating principle furnished by the male. It is heavier than water, and, when shaken with it, forms an emulsion. Its odor is peculiar, and has been justly compared to that emitted by bone filings, or the flower of the chestnut-tree; Wagner states that the odor is due rather to the secretions with which it is mixed than to the sperm itself, the latter, when pure, not appearing to possess any particular smell. By chemical analysis it is shown to contain albumen, salts of phosphoric and chlorohydric acids, and a peculiar animal substance called *spermatine*.

When examined under the microscope, with a magnifying power of three or four hundred diameters, the spermatic fluid exhibits: 1. A great number of little bodies, lying quite close to each other, and which are still moving with more or less activity if the fluid has been taken from a recently-killed animal; these minute bodies have been designated as the *spermatic animalcules*, or the *spermatozoa*. 2. Epithelial cells and minute granules of a fatty nature. 3. These two principal elements of the sperm swim in a small quantity of clear, transparent, and perfectly homogeneous liquid,—the *spermatic liquid*. At the time of the ejaculation, this liquid is mixed with a variable quantity of the fluids secreted by the prostate gland and the glands of Cowper, which latter evidently serve merely to lubricate the parts, to render the sperm more fluid, and, consequently, its expulsion more easy.

The spermatic animalcules attract particular attention by their varied form, their vital properties, and their development. They are met with in all animals capable of reproduction.

In man they are very small, scarcely surpassing the eightieth or the hundredth of a line in diameter. The body is small, oval, somewhat flattened like an almond, and transparent, having a diameter equal to the three or four hundredth part of a millimetre (·001 of an inch). The tail is filiform, thicker at its origin than at any other part, and is large enough to present clearly its double outline; towards the extremity it becomes so fine

that it cannot be traced, even by means of the highest magnifying power whence it may be possible that its delicate extremity is still further elongated, and that the spermatozoa may be much longer than they appear

It is impossible, says Wagner (from whose able works I extract this paragraph), to decide whether the spermatic animalcules have an animal organization, that is, whether they are true animals with an independent life, or not; and all that is either known, or plausibly supposed on this point, may be reduced to a few obscure indications, that are wholly insufficient to establish any positive opinion.

The movements which they exhibit prove nothing, because it is exceedingly difficult to ascertain whether they are voluntary or not. Again, the duration of the movements also varies in the different classes of animals; in the mammalia, they have been observed for twenty-four hours after death.

The spermatozoa do not appear in the human species before puberty; at this period, the testicles receive a large supply of blood, and increase in size; the parietes of the semeniferous tubes become thickened, their capacity increases, and they are filled with granules; then cells containing globules begin to form, and finally the spermatozoa appear in these cells. They are always found in the testicles of men of sixty to seventy years of age, though they are then frequently absent from the vas deferens; the vesiculæ seminales, however, generally contain them even at this time of life.

The germ furnished by the female is evidently existent in the ovary at the marriageable period, and this germ is the ovule. (See p. 90 for its description.)

2. It is unnecessary in our day to prove that an absolute contact of the semen of the male with the ovule of the female is indispensable to fecundation, for innumerable experiments upon living animals, and numerous facts observed in the human species, have long since demonstrated that, whenever any obstacle prevents the approach of these two elements, a conception cannot take place. But at what point does this contact occur? Already had the pre-existence of the ovule in the ovary, the occasional occurrence of ovarian and abdominal pregnancies, and the experiments of Nuck and Haighton, which had rendered fecundation impossible by ligating the Fallopian tubes, tended towards the conclusion that it occurred in the ovary; still this fact was not actually demonstrated, and it needed the definitive proof of finding the spermatozoa on the ovary itself. At present, there cannot be a further doubt on this point, for Bischoff has been fortunate enough to see them there. "I had often seen," says he, "living and moving spermatozoa in the vagina, the womb, and the Fallopian tubes of bitches; but, on the 22d of June, 1838, I had the good fortune to perceive one on the ovary itself of a young bitch in heat for the first time; she was covered on the 21st, at seven o'clock in the evening, and again the following day, at two o'clock P. M., and at the expiration of half an hour, that is, twenty hours after the first copulation, I killed her, and found some living spermatozoa, endowed with very active movements, not only in the vagina, the entire womb and tubes, but even between the fringes of the latter in the peritoneal pouch that surrounds the ovary, and on the surface of this organ itself." Since that period, Wagner and Barry have made the same observations.

Now such results evidently prove that fecundation sometimes takes place in the ovary; but are we hence to conclude, that it is possible in that organ alone? If spontaneous ovulation be now an incontestable fact, may it not be supposed that the ovule, after having left the ovary, can encounter the spermatic fluid and become fecundated, whether it be in the Fallopian tube, or even in the uterine cavity?

[M Coste's observations seem, however, to prove that fecundation is almost always effected either upon the ovary or in the part of the tube nearest the fimbriated extremity; inasmuch as he maintains that the ovule spoils very quickly when it enters the tube without previous fecundation.]

But the question arises, how does the fluid ejaculated by the male get as far as the ovary? We answer that, in the great majority of cases, it is evident that the sperm having first reached the uterus, upon the neck of which it was thrown by the membrum virile, travels through the tube until it arrives there. This course is certainly due, 1st, to the movements proper of the womb and the tubes; for in the latter, a rapid contraction is observed, following the direction from the vagina towards the ovary, which, of course, is calculated to assist the progression of the sperm; and 2d, to the movements proper of the spermatozoa, which thus of themselves facilitate their own advancement.

3. This first point being once established, the question naturally arises, what was the influence exercised by the sperm upon the ovule of the female during the contact? Now, numerous experiments clearly prove that the sperm owes its fecundating properties to the presence of the spermatic animalcules, and that, whenever it is deprived of these, it immediately becomes unsuited to its proper function. But, unfortunately, it is far more difficult to ascertain the part acted by the spermatozoa, though there have been three hypotheses started in regard to that subject deserving our consideration.

Again, according to certain authors, the fecundating power does not belong to the spermatozoa, but to the seminal liquid interposed between them. In this hypothesis, the animalcules are the *transporters* of this fluid, and the object of their movements is to conduct it to the ovule.

In the opinion of Bory-Saint-Vincent, Valentin, and Bischoff, the spermatozoa are solely destined to maintain the chemical composition of the sperm by their active motions. They suppose that the spermatic fluid is a substance endowed with a chemical sensibility of such a character that, like the blood, it can only preserve the fecundating power while it remains in motion; whence these active elements are inclosed in it whose presence is indispensable—elements, the movements of which are never more active than just at the moment when the semen leaves the place of its secretion, and which appear to exercise the most favorable influence for the maintenance of its composition.

[The oldest view is, that during fecundation the spermatozoids penetrate directly into the ovum. Barry even asserted that there existed in the ova of rabbits an opening for this purpose, and he had once the good fortune to see a spermatozoon enter by means of the fissure.

For a long time this view was thoroughly contested, but has now come into favor again. In 1854, Meissner saw in the ova of a rabbit spermatozoa within the transparent zone and in immediate contact with the yolk. The observation was verified by Wagner, Heale, and several others; and M. Coste, whilst examining the ova of salmon and trout, discovered in the vitelline membrane a well-defined microscopic opening provided with an internal valve. In other ova, M. Robin saw spermatozoa inside of the vitelline membrane without being able to discover the opening through which they had passed.

Similar observations have become so numerous, that the passage of more or less spermatozoa into the ovum itself is regarded as an established fact. Once within the ovum, they undergo a retrograde metamorphosis, and are resolved into granulations which mingle with the elements of the vitellus or yolk.]

This is a summary of the most recent opinions. Whichever one may be adopted, the mind remains unsatisfied; for it must be acknowledged there is still a mystery that all the most ingenious hypotheses have failed to solve, and which will probably escape all our researches.

When fecundation takes place, the Fallopian tubes, which participate in the stage of turgescence of all the other genital organs, retain their free extremities in contact with the ovary, and the ovule, having escaped from the vesicle, immediately engages in their canal; being pressed onwards by the peristaltic contractions of the tube, it advances step by step through this duct, and finally arrives in the uterine cavity, where its development unceasingly progresses until the regular term of pregnancy. (See the chapter on *Ovology.*)

Nearly the same phenomena take place, when the contact of the fecundating fluid with the ovule is deferred until after the latter has passed into the tube.

It is extremely difficult, not to say impossible, to ascertain the exact period at which the fecundated ovule reaches the cavity of the womb. In animals, we may note without difficulty the time of fecundation; but this, of course, is generally impossible in the human species, and this obstacle renders nearly all our observations uncertain and incomplete. Further, very numerous researches have clearly proved that the ovule in mammalia does not always arrive at the same moment in the womb, and it is exceedingly probable that the same variations exist in the human female.

In the present records of our science, there is no one conclusive fact that proves the ovule to have ever been seen in the womb of a woman prior to the tenth or twelfth day after her conception.

Baër examined a woman, who committed suicide eight days after conception; the deciduous membrane had commenced forming, but he could not detect any trace of the ovule in the uterus. (*British and Foreign New Review*, January, 1836, p. 328). The same occurred in the cases cited by Weber (*Disquisitio anatomica uteri et ovariorum puellæ, septimo a conceptione die defunctæ instituta*). Dr. Pockels speaks, it is true, of an ovum of eight days, found in the uterus, and in which *the fœtus could easily be distinguished;* but the description furnished by him evidently applies to an older product. (Allen Thompson, in the *Edinburgh Med. and Surg. Journal*, vol. lii. p. 122.) Ovules of eleven days were the youngest observed by M. Velpeau.

After the exit of the ovule, the Graafian vesicle soon retracts upon itself, and thus contributes to the formation of the corpus luteum before spoken of (p. 96).

We shall hereafter describe the modifications which the ovule undergoes during its passage through the tube, and after its arrival in the uterus.

Conception is an act that takes place unconsciously, and altogether involuntarily; although some females, more especially those who have had children, imagine that they can distinguish a prolific connection from others. They say a much more voluptuous sensation is then experienced, a spasm much better marked; and I have met with too many females who acknowledged having made this observation, not to believe there is some truth in the assertion.

The same ignorance that prevails as to the causes of fecundation, likewise exists with regard to those opposing its accomplishment. For, though vices of conformation or faulty position of the uterus, as also obliterations of the neck or tubes, may explain the sterility of some individuals, it is wholly impossible to understand why some women are barren, although well formed — why, in a considerable number of cases, married females have not had children during their first marriage, whereas they subsequently became pregnant, when even it has been observed that the first husband had children by a former bed.

The period at which fecundation is most likely to take place, appears to be that immediately following the flow of the menses; thus M. Raciborsky has ascertained that the conception took place a little before or after their appearance, in fifteen females, who could designate precisely the time of the sexual approach. It is indeed evident, that everything seems admirably prepared at this period for the reproduction of the species; but I am far from concluding, as M. Raciborsky has done, that the aptitude for fecundation in the human race is limited to a few days, either preceding or following the menstrual terms. Experience has convinced me that sexual intercourse may be fruitful, even when it takes place in the middle of the interval between the two menstrual epochs. In this case it is probable that the excitation produced by coition may be communicated to the ovarian vesicles, and cause modifications in them altogether similar to those experienced in the menstrual evolution; the fact itself appears to me to be settled beyond a doubt.[1]

[1] M. Coste, who also admits the possibility of conception without regard to the period at which copulation takes place, is prepared, he says, to demonstrate by undeniable proofs, that the ovum detached from the ovary during, or towards the close of menstruation, loses all capacity for fecundation within a very few days after being set free. Conception is, therefore, only possible at other times than near or during the menstrual epochs, when other circumstances happen to produce in the ovary an operation similar to that which takes place at the period of heat. Now is this possible? Comparative physiology replies in the affirmative, by demonstrating it to be so as regards certain animals, thus rendering it at least very probable for the human species also.

In animals living in the savage state, says the learned professor of the College of France, the ovaries accomplish their functions only at rare intervals; but when domesticated, the maturation of the eggs may become so frequent in certain species,

I shall not undertake to refute the opinion of those who believe that either sex can be created at will; yet I think it not improbable that the physical constitution of the husband or of the wife may have some influence in determining the sex of the child. The admirable observations of M. Girou seem to me to have proved that with the inferior animals, at least, the stronger the male is in comparison with the female, the greater is the chance of producing a male, and *vice versa*. The observations I have been able to make on the human family since reading the statistical results of M. Girou, have generally confirmed their conclusions.

Here terminates what I had proposed to say in reference to fecundation. It will be seen that I have limited it to a very brief exposition of the most generally received views of this point of physiology. The size, and especially the object of the work, seem necessarily to exclude more ample details.

that the ovulation occurs almost daily. Thus the wild pigeon, which deposits her eggs but once or twice a year, sets seven or eight times, when she takes up her abode in our dove-cotes. Under the influence of an appropriate nourishment, our domestic fowls lay almost every day for eight months in the year. The rabbit of the fields brings forth but once or twice yearly, whilst living at large; but in the domestic condition, she will reproduce as often as seven times, if care be taken to wean the young at the proper moment.

There are therefore conditions of shelter, of temperature, and of alimentation, which, by acting on the organism of animals, may cause their ovaries to exercise their functions more frequently in a given space of time. To this it may be added, that in mammalia, the cohabitation of the males is one of the most active accelerating causes of the dehiscence of the vesicles. Thus, for example, a female rabbit when placed alone in a cage where she is completely protected from the attempts of the male, enters ordinarily into heat about every two months, and when the time of this periodic excitement is past, she refuses obstinately to submit to coition; but if, instead of separating her from the male, whom she then repels with violence, he be allowed to remain with her for a few days only, it may be regarded as certain that she will not resist long, because the solicitations to which she will be incessantly subjected will provoke the return of a condition which, in the absence of this excitement, would have been much longer in appearing.

There are, therefore, natural and entirely spontaneous periods for the maturation and discharge of ova, and there are also others which may be styled artificial, because it is possible to produce them through the means of external agents.

Now, is it possible to suppose that the human female, who commands all these conditions at her will, is, by an inexplicable exception, inclosed within the impassable boundaries of her menstrual periods? And if, in spite of her first vigorous resistance to the attempts of the male, the rabbit finally yields to the influence of his companionship, why in woman, who of all the females of the mammalia is endued with the most constant readiness for coition, should not the sexual allurements have the same result?

This accidental evolution of a vesicle is not followed by the menstrual flow which ordinarily accompanies it; all which is very comprehensible, for we must not forget that the same cause which provokes the discharge of the ovule, is also that which fecundates it, and that in doing so, it arrests the tendency to hemorrhage before it has time to appear. (Coste, *Histoire générale et particulière du developpement des corps organisés.*) The same thing, in fact, happens when fecundation occurs a few days or hours only before the appearance of the menses.

CHAPTER II.

CHANGES IN THE MATERNAL ORGANISM DURING PREGNANCY.

A DEEP impression is produced upon the maternal organism by the pregnant condition, giving rise to important anatomical and functional alterations.

ARTICLE I.

ANATOMICAL CHANGES IN THE UTERUS.

The uterus undergoes remarkable changes, and we shall commence our description with them.

These modifications may either be in the volume, form, situation, direction, and relations of the womb; hence, on account of their great importance, we shall successively study them in the body and in the neck; then we will point out the changes which the structure of the organ undergoes.

§ 1. CHANGES IN THE BODY OF THE UTERUS.

A. *Volume.*—We have already learned that under the influence of the hemorrhagic congestion which the uterus undergoes at each menstrual period, the bulk of the organ is increased. If conception takes place within a few days preceding or following the flow of the blood, the excitement produced by the fruitful coition maintains, and soon increases the hypertrophy of its walls. Thus, we shall find further on (see *Decidua*), that the mucous membrane especially becomes almost doubled in thickness, so that when the fecundated ovule arrives in the cavity of the womb, it finds it entirely filled with the membrane, which is swollen to such an extent as to be thrown into folds from want of room to develop itself. (See page 95.)

The same thing precisely occurs in those exceptional cases in which fecundation takes place some time from the menstrual period. Here the hypertrophy also begins under the influence of the evolution of a Graafian vesicle; only the evolution, instead of being spontaneous, is the result of a more or less prolonged venereal excitement.

As soon as the ovule arrives in the womb, the latter begins to develop, and its volume continues to increase until the end of pregnancy; but this progression is not uniform, for, according to the observations of Desormeaux, it is much slower in the early months, and more rapid in the latter. An accurate idea of this increase may be formed from the following table, which represents the usual dimensions of the uterus at the principal periods of pregnancy.

	VERTICAL DIAMETER.	TRANSVERSE.	ANTERO-POSTERIOR.
Third month, . . .	2¾ inches.	2¾ inches.	2¾ inches.
Fourth " . .	3¾ "	3¾ "	3¾ "
Sixth " . .	8¾ "	6¼ "	6¼ "
Ninth " . . .	12½ to 14½ "	9½ "	8¾ to 9¼ "

The development of the uterine walls is not purely mechanical, as has been supposed, nor is their distention the result of the development of the ovum, which, by pressing upon the different points of the internal surface, would tend to separate them more and more.

If we consider the small volume of the ovule in the first weeks of pregnancy, as compared with the thickness of the walls of the uterus at the same period, we shall not fail to be convinced that the expansive force of the ovum would be unable to overcome their resistance. The development of the ovum and that of the uterus are simultaneous, but effected by forces which are inherent in each; in a word, the growth of the ovum acts as a physiological cause, but not as a mechanical agent in the development of the walls of the uterus.

B. *Shape.*—The shape of the uterus changes simultaneously with the alteration in its volume. Being flattened, at first, on its two faces, the womb grows rounder and soon becomes pyriform, then spheroidal, and towards the end of pregnancy it has the form of an ovoid, which is slightly flattened from before backwards. The anterior face, however, is much the more convex, and the posterior one is depressed, so as to accommodate itself to the prominence of the lumbar vertebræ.

At the end of pregnancy, the superior extremity of the uterine ovoid is quite regularly rounded; that side of the fundus, however, which is occupied by one of the extremities of the fœtal ovoid, being often more elevated than the other, which is filled with fluid only. Now, as in the most usual presentations, the trunk of the fœtus is generally inclined towards the right, the right side of the fundus of the uterus is commonly the most elevated. (Hergott.) Sometimes both sides are alike in this respect, and there is a depression upon the middle and upper part of the organ.

Such is the shape of the uterus in the majority of cases; but the situation and number of the fœtuses, and the structure and primitive form of the organ, may produce important changes in the shape which it assumes during gestation; and which will claim our attention hereafter.

C. *Situation.*—It is evident that the uterus cannot thus change in shape and size, without undergoing a simultaneous alteration in its position; for example, during the first three months of gestation, the womb remains sunken in the excavation, but as the volume increases in all directions, the fundus of the organ rises towards the superior strait, whilst its inferior part and neck subside still more towards the floor of the pelvis. This depression of the organ is produced by its yielding to the laws of gravitation from its own increased weight, as also by the augmented pressure of the intestinal mass upon the larger surface, created by the change in the fundus. Hence, both its increase of volume and its weight, augmented by the pressure of the intestinal mass, which now has an extensive *point d'appui* on the fundus, contribute to produce the first change in position.

At the same time, the uterus remains in the sacral cavity from the greater space found there, and, the fundus being turned a little backwards, causes the neck to advance slightly. Besides, the presence of the rectum on the left most generally obliges the organ to deviate towards the right, and the neck, in a corresponding manner, to the left; consequently, during the first

three months, the cervix is directed downwards, forwards, and a little to the left.

About the third month and a half, or the fourth month, the uterus, no longer finding sufficient room in the excavation for its continued development, rises above the superior strait, then to the level of the umbilicus, and reaches the epigastric region towards the end of pregnancy.

In tracing out the gradual elevation of the fundus uteri, it will be found, at the fourth month, to rise two or three fingers' breadth above the pubis; at five months, it is within one finger's breadth of the umbilicus; and from the fifth to the sixth month, it approaches and passes the umbilical depression, so that at six months it is half an inch above this ring; three fingers' breadth at seven months; and four to five at eight months; it still continues ascending in the commencement of the ninth, but in the last fortnight of gestation, the womb seems to sink down, being, in fact, on a lower level than before. This last is a remarkable occurrence, though it has been said in explanation that the uterus, as if overburdened with the weight of the fœtus during the latter period, collapses to some extent, and enlarges in the transverse and the antero-posterior diameters. This may be true as regards some females who have previously had children, for not unfrequently they say to us at this time, "It has all gone to the sides;" but I believe a more general explanation of the fact may be given; for, in the great majority of cases, if females be "touched" near the end of pregnancy, a voluminous tumor, covered by the inferior and more especially by the anterior part of the uterine body, will be readily felt occupying the excavation. This is the head of the fœtus, which has descended in consequence of its own weight, carrying the wall of the uterus before it, and become engaged in the excavation, sometimes even as low down as the floor of the pelvis.

Now, does not this circumstance, which may be remarked whenever the head presents regularly, and when there is no malformation of the pelvis, furnish us a sufficient reason for the depression of the entire uterus? How, in fact, could the superior do other than follow the inferior part of the organ?

D. *Direction.*—In passing up into the abdominal cavity, the uterus is obliged to follow the direction of the axis of the superior strait, and being thrown off by the lumbar column, and finding much less resistance from the anterior abdominal wall, it necessarily inclines forward; but, owing to the lumbar projection, it cannot possibly remain on the median line, and hence it leans towards one side of the abdomen, the right one, remarkable as it may seem, at least eight times in ten.

Most authors, since the days of Levret, have endeavored to explain this great frequency of the right lateral obliquity. Levret himself taught, that the uterus always inclines towards the side where the placenta is inserted; for this point, he said, being the thickest and most vascular part of the whole organ, is also the heaviest, and this increased weight augmented by that of the placenta, must necessarily draw the organ to that side; but experience has shown that the placenta is far from being always inserted on the one side towards which the uterus is inclined. Again, according to Desormeaux, the presence of the iliac portion of the colon, which is usually filled with fecal matter, prevents the womb from leaning to the left, when

it commences ascending out of the excavation, and thrusts into the right iliac fossa, whilst the mass of the small intestines is pushed to the left side by the ascent of the womb (where the direction of the mesentery *would naturally* draw them), and this assists both to maintain and to increase the inclination of the uterus to the right. But, as M. Paul Dubois has justly remarked, any influence which the colon, placed on the left, may have, is fully compensated by the presence of the cœcum on the right; and, from the observation of M. Velpeau, the mesentery is directed from left to right, and not from right to left as Desormeaux has it, doubtless by mistake.

The habit of using the right arm, and of lying upon the right side, has also been brought forward in explanation of this right lateral obliquity, but subsequent observation has not sustained the assertion; thus, for instance, in seventy-six females, all of whom had the uterus inclined to the right, thirty-eight rested on the right side, twenty on the left, fourteen alternately on both sides, and four on the back. And we may further remark that, down to the present time, it has not been observed that the uterus is placed upon the left side of the abdomen more frequently in those women who habitually use the left arm than in others.

Madame Boivin has given an entirely different explanation of this fact; she asserts that the round ligament of the right side is shorter, stronger, and contains more muscular fibres than that of the left, and she attributes the right inclination of the organ to the more powerful action of this ligament.

Professor Cruveilhier thinks that the shortness of the round ligament on the right, is the effect and not the cause of the uterine obliquity; "for I have frequently had occasion," he remarks, "to observe that the shortening which occurred on the left, in left lateral obliquity, was constantly accompanied by a remarkable increase of volume." I must confess that I do not comprehend upon what M. Cruveilhier founds this opinion.

[In order to test Madame Boivin's explanation, M. Pajot, in connection with Dr Rambaud, former prosector to the hospitals, undertook new measurements of the length of the two round ligaments.

From their investigations it would appear, that even in women who have been delivered, the left round ligament is not so often the longer as has been supposed, and more especially is this greater length far less common than the right lateral inclination of the womb during pregnancy.

All the explanations of the fact being then so unsatisfactory, M. Pajot comes to the conclusion that the inclination of the pregnant uterus is due to the mode of evolution of the organ itself.

Beside this lateral inclination, the entire womb undergoes a rotation upon its axis, which carries its anterior surface a little to the right, whilst the posterior surface looks backward and to the left.

From this it results, that, if during an autopsy the abdominal parietes be removed without disturbing the womb, the annexes of the uterus and the ovary of the left side are found in front, whilst the same parts belonging to the right side are concealed behind near the right sacro-iliac symphysis.]

E. *Relations.*—At term, the uterus is in relation—1. In front, with the vagina, the posterior face of the neck and body of the bladder, and superiorly, with the anterior abdominal wall. This last is not always

immediate, for occasionally a portion of the intestinal mass slips between the uterus and the ventral parietes, as occurred in the woman upon whom M. Dubois practised the Cæsarean operation in 1839; and, as the professor has remarked, the operator should be very prudent in making his incisions, from the possibility of encountering this anomaly. 2. Behind, with the rectum, sacro-vertebral angle, and vertebral column below, and with the mesentery and intestinal mass above. 3. On the right, with the corresponding side of the pelvis, the iliac vessels, psoas muscles, cœcum, and right abdominal wall. 4. On the left, with that part of the pelvis, the iliac vessels and aorta, the sigmoid flexure, the psoas muscles, and the whole body of intestines which separate it from the abdominal wall.

F. *Thickness of the Parietes.*—The earlier authors on this subject entertained very different views concerning it: some, judging the thickness of the body by that of the neck during labor, concluded that the uterus could not be distended without a great diminution in the depth of its walls; others, having had better opportunities of examining the wombs of females who died soon after the accouchement, observed the very considerable thickness exhibited by the uterine parietes at that time, and therefore adopted the opinion that the latter become much thicker during gestation.

Both sides were in error, for numerous autopsies, made since that period, of women who died during gestation, have established the truth of the following propositions, namely:

1. In the three first months, the uterine walls augment a little in thickness, doubtless in consequence of the development of their vascular and muscular apparatus. 2. Towards the fifth month, they are about the same as in the normal state. 3. At term, the parietes are thicker than in the natural condition, at the point corresponding to the insertion of the placenta, thinner at the neck, and they present but very little difference throughout the remainder of their extent.

We may here notice some further exceptions: thus, M. Moreau, having measured the thickness of the walls in a woman deceased at term, found it one-sixth of an inch at the fundus, one-fourth of an inch at the insertion of the placenta, and one-third of an inch at the neck. This singular anomaly may be explained, says M. Moreau, 1st, as regards the thinness of the fundus, by the enormous distention the uterus had undergone (being a twin pregnancy). And 2d, the greater thickness of the neck resulted from the considerable retraction this part had sustained from the escape of the amniotic liquid before death.

In one instance, Saviard found it one-third of an inch at the placental attachment, and only a line in other parts.

My friend, Dr. Ripault, in performing the Cæsarean operation, found the uterine wall only one or two lines thick.

[At an autopsy made near the end of pregnancy, I found the walls of the uterus remarkably thin, from $\frac{1}{16}$ to $\frac{3}{16}$ of an inch, throughout the greater part of their extent; M. Nélaton, who was present, confirming the observation. This thinning is, therefore, not very unusual, and I am even inclined to think is the most frequent condition.

In many pregnant women, the parts of the child may be felt very easily; in some

cases the hand appearing to be separated from them by a layer of but a few lines in thickness. Notwithstanding all this, it is nevertheless true that the entire bulk of the uterine walls undergoes considerable increase during gestation in consequence of the great extension in surface.

To prove this, it is only necessary to weigh the uterus of a woman dead at the end of her pregnancy, when it will be found that the weight of the organ, after separation from the neighboring parts and removal of its contents, will vary from three to almost four pounds. In the case of M. Moreau, above cited, it was nearly four pounds.

The uterus, therefore, increases at least twenty times in weight during pregnancy, a fact surely sufficient to prove the occurrence of hypertrophy under these conditions.]

Again, the thinness may be partial; thus Hunter describes a uterus, the posterior walls of which exhibited this phenomenon in a remarkable degree.

G. *Density of the Walls.*—The uterine parietes, in the non-gravid state, are very hard and resisting, and have nearly the consistence of fibrous tissue, but during pregnancy this density diminishes and the walls become soft and flabby. The ramollissement begins to show itself as early as the first month, and constitutes at that period one of the best signs for proving a commencing pregnancy (see article on *Diagnosis*), because, instead of presenting the fibrous density of the ordinary state, the walls have a clammy softness closely resembling that of caoutchouc softened by ebullition, or that of an œdematous limb. This decrease in the consistence of the uterine walls constantly advances, so that, at a later period, a light pressure made on the anterior abdominal parietes will easily depress or deform them; consequently, the extremities and other inequalities of the fœtus may be detected, and its movements may even cause an elevation of some part or other; the child, therefore, is not placed in a cavity having immovable walls.

The diameters of this cavity will vary with the position taken by the fœtus, which can, in some cases, continue to change them until the end of gestation, the flexibility of the walls permitting its long diameter to pass through the small ones of the organ; and we can readily comprehend how this flexibility, this suppleness of the fibres of the womb, will aid in preventing the disastrous consequences which otherwise might result to the child from any violent blows on the abdomen, or from the shocks experienced by the mother.

§ 2. Modifications in the Neck of the Uterus.

The modifications which the neck undergoes during pregnancy, are referable: 1, to the consistence of its tissue; 2, its volume; 3, its form; 4, its situation and direction.

1. As the softening of the tissue of the neck of the uterus seems to be an all-important fact, we therefore give it the first place.

Now, everybody knows, that, in the non-gravid state, the uterine tissue resembles the fibrous in its consistence; but immediately after conception, and from the sole fact of the active congestion which the genital organs then experience, this consistence begins to diminish, although, from being coincident with the hypertrophy of the uterine walls, it is scarcely sensible

during the first few days, whatever may be the extent of the neck examined. But towards the end of the first month we may ascertain that, independently of this original general modification, the most inferior, or rather, the most superficial part of the lips of the os tincæ, begins to soften. It resembles more a swelling of the mucous membrane than a true "ramollissement" of the proper tissue of the lips; so that by pressing slightly on this thickened membrane the finger first detects a fungous softness, but soon reaches the proper tissue of the neck, which still maintains its normal consistence. The sensation then experienced by the finger greatly resembles that communicated when it is pressed on a table covered by a soft and thick cloth, or, better still, a sheet of India-rubber; and it is only towards the end of the third, or beginning of the fourth month, that the lips of the os tincæ are softened throughout their whole thickness to the extent of a line or a line and a half.

At the commencement of the fifth, the softening increases from below upwards, and at the sixth embraces the moiety of the sub-vaginal portion. During the last three months it invades the superior part by degrees, and last of all the ring of the internal orifice, so that, at the end of gestation, the neck is so soft in certain females, that I have frequently seen students have great difficulty in distinguishing it from the walls of the vagina.

This modification of the neck, which authors have scarcely spoken of, is one of the most important signs; because, after a little experience, it affords us one of the best means for ascertaining the different stages of pregnancy; being constant, and found in all females, unless the neck should be the seat of some pathological alteration. It is worthy of notice, however, that the softening is not so well marked, and is much slower in its progress in primiparæ, than in women who have previously had children; but in all, it steadily proceeds from below upwards.

As, before remarked, we may judge very nearly of the probable period of pregnancy by the extent of softening, as it progresses from the inferior to the superior part of the neck; though there is one important remark to be made on this subject, namely, that whenever females have had a great number of children, the sub-vaginal portion of the neck loses the greater part of its length; the extremity then projecting into the vagina, and capable of exploration by the finger, being much shorter. Now, as the softening of the supra-vaginal portion of the neck is of much more difficult detection, it may be thought to be much less extensive than it is in reality, whence we may expect to find a great difference in the extent of the softened part, if a comparsion be made between the necks in two females, both advanced to the sixth month, one of whom is pregnant for the second time, and the other had previously borne ten children. Wherefore it is necessary, in making this appreciation, to bear in mind the number of former pregnancies, as also the real length of the sub-vaginal portion of the cervix.

2. *Volume.*—Some singular ideas on this subject have been promulgated by many authors, but the following appears to be the most constant rule: the neck doubtless participates in the hypertrophy of the uterine walls during the earlier months, though its development is far less considerable. The neck becomes thicker and grows more voluminous, especially at the

superior part, but I have never observed its elongation to the extent of two inches, as Madame Boivin apparently believes, or to two and three-quarters and three inches, as M. Filugelli has more recently advanced; for, as elsewhere observed, these opinions result, in my estimation, from an error. The neck, in the commencement, being much lower, and directed more in front than in the ordinary condition, the finger can easily explore a larger extent of it, and thus an impression is created of an increase in its length which really does not exist; for frequent post-mortem examinations of females who died in the early months of pregnancy, have convinced me that, even if the neck is increased in thickness, its length does not undergo any appreciable augmentation.

At the commencement of the fifth month, according to most writers, the cervix begins to diminish. In the sixth month (they say) it begins to spread out at the superior part, so as to aid in the enlargement of the body of the womb, and this spreading at the upper part continues to advance in proportion as the term of gestation approaches, and consequently the length of the neck decreases from above downwards, so as merely to present at last, at the close of the ninth month, a ring of variable thickness. In fact, the diagnosis of the different periods was based on this gradual shortening, and, agreeably to the majority of the French accoucheurs who have adopted the opinions of Desormeaux, the neck has lost at the fifth month about one-third of its length, one-half at the sixth, two-thirds or three-quarters in the seventh, three-fourths or four-fifths in the eighth, and the remainder is effaced during the course of the ninth month; and yet, I do not hesitate to pronounce all this an entire error, which was first pointed out by M. Stoltz, in 1826, and to which I also have constantly asked attention since the year 1839. No; the neck does not shorten in the way which has so long been described; it preserves its whole length until the last fortnight of pregnancy; and it is an easy matter, especially in women who have previously borne children, to verify this remark, as we shall presently demonstrate. But during the last few weeks, its length, which until that time was intact, diminishes very rapidly, and even disappears by a total effacement; and we shall in due season explain the simple mechanism of this phenomenon.

But to return; I have frequently been enabled to prove, in primiparæ, the truth of M. Stoltz's assertions; for in these women the neck does diminish a little in length, during the last three months, although by a process entirely different from that described by Desormeaux. Thus, towards the seventh month, the ramollissement has invaded the whole intravaginal portion; the parietes of the neck, having lost their consistence, are easily separated by the liquids secreted upon their internal face, and the upper part of this portion being turned outwards, enlarges in such a manner as to cause the whole neck to resemble a spindle in its shape; the superior extremity of which is formed by the internal orifice (still closed), and the inferior is constituted by the external one, which is scarcely opened in primiparæ, even at the end of gestation, as we shall hereafter show

A section, showing the neck of the uterus; the anterior and posterior lips are seen *in situ*, being separated from each other by the fusiform cavity of the neck.

Now, it is easily understood how this bulging of the middle part of the neck can only take place just in proportion as the two extremities of the latter approach each other; thus, of course, detracting so much from its total length. I do not believe, however, with M. Stoltz, that the approximation of the two orifices can be so great as to cause a material shortening of the neck, though this certainly does exist to some extent. The shortening of the neck is therefore real, though slight, in primiparæ; being accomplished, however, by a different mechanism from that taught by most authors. Its upper part does not spread out so as to contribute to the enlargement of the cavity of the body, but suffers a sort of collapse, which brings the two orifices nearer together, at the same time increasing its central cavity, and extending its transverse diameters at the expense of the vertical. What has been said concerning the rapid effacement of the neck during the last few days in multiparæ, equally applies to primiparæ; the process taking place by the same mechanism.

3. *Form.*—The principal modifications in the shape of the neck have already been presented, but they ought to be studied in a more special manner, according to whether they are found in primiparæ, or in women who have previously been mothers.

A. At the commencement, in primiparæ, the cervix appears more contracted and more pointed, resulting, perhaps, from the augmentation of its superior part in volume; the orifice of the os tincæ, which, before conception, presented a simple linear and transverse fissure, now assumes a circular form, constituting, as it were, a small lenticular fossa. A little later, as mentioned above, the middle part of the cavity of the neck enlarges, so as to give to the whole cervix the form of a somewhat elongated spindle, rather than that of a cone, which it previously had. It continues smooth and polished on the exterior surface, and the periphery of its orifice is rounded, without any irregularities or fissures; sometimes presenting a soft circumference, at others a thin and sharp border: the latter rarely happens, however, before a very advanced stage. At this time, it is very easy to ascertain what changes the neck has undergone, for although the external orifice is constricted, it is very much softened, and sometimes allows the finger to pass with a very slight effort and enter the cavity of the neck. The base of the last phalanx is then felt to be grasped quite tightly by the external orifice, whilst the extremity of the finger is at full liberty in the fusiform cavity of the neck. It may also be readily observed that the two orifices are still widely separated, for the entire length of the first phalanx and sometimes more, are capable of being contained in the cavity.

FIG. 40.

FIG. 41.

FIG. 42.

These three figures give an idea of the gradual dilatation which the cavity of the neck undergoes at various periods of pregnancy.

B. The form of the neck is altogether different in women who have had children; thus the inequalities and protuberances exhibited by the inferior part will scarcely permit us to ascertain whether it becomes more pointed or not, and it is equally difficult to determine whether the external orifice has become more rounded; because, having been somewhat patulous before pregnancy, this orifice, in consequence of the numerous cicatrices found on it, presents a very irregular opening. The only point capable of demonstration in the early periods is, that the partially opened orifice will dilate still further, so as to admit readily the extremity of the fore-finger.

This spreading out of the os tincæ, and the inferior part of the neck, constantly increases from below upwards, as the gestation progresses; it reaches the middle part of the cervix about the seventh month, and nearly gains the internal orifice by the ninth.

The enlargement of the cavity of the neck advances simultaneously with the softening of its walls; and we can easily prove by experiment that the finger will each month penetrate deeper into it. The shape of this cavity resembles in some women that of a thimble, in others, of a funnel, with the base below and the apex above, the difference being due simply to the depth and number of the ruptures which had existed on the external orifice before pregnancy.

The part of the neck not yet softened and dilated constitutes the summit of the cone: that is, every portion of its length contributes in succession; so that the first, and often even the half of the second phalanx of the finger can penetrate into its cavity towards the ninth month, the extremity of the finger being only arrested by the internal orifice, which is still closed and puckered like the knot of a purse. The ring at this orifice finally softens, becomes dilated, and permits the finger, which has passed through a canal an inch to an inch and a half in length, formed by the cervix, to come into direct contact with the naked membranes. If the length of the external surface of the neck be compared at this period with the canal in which the finger is introduced, the neck will be found much longer internally than exteriorly, for it is self-evident that the finger is arrested on the outside by the vaginal insertion, whilst within it traverses the whole space between the two orifices.

The internal orifice sometimes opens too soon; thus Desormeaux declares that he touched the membranes at the end of seven months, over a space of an inch and one-third in extent. I also have verified the same fact, but only in women who were subject to floodings, or in those who submit to "the touch," in our public lessons, for, in these latter, the frequently repeated and careless introduction of a great number of fingers, has appeared to me to greatly accelerate the softening and dilatation of the neck.

On the whole, therefore, the neck is fusiform in primiparæ, the external orifice is rounded, and so little dilated as to prevent the introduction of the finger without some considerable effort. In females who have had children, the external orifice is widely open, and the cavity in the neck is funnel-shaped, the base being below, and continues to increase until its apex reaches the internal orifice. This latter remains closed in both, in a vast majority of cases, until the beginning of at least the last month of pregnancy

These differences in the form of the neck in primiparæ and of multiparæ, are readily accounted for when we take into consideration the condition of the external orifice before pregnancy in both cases. The os tincæ of women who have already had children, has the continuity of its circumference interrupted by a greater or less number of ruptures, so that as soon as a small part of the neck has become softened, each of the divisions of the circumference being fixed only by its upper part, is turned outward, so as to give to the orifice the form of the large extremity of a trumpet. In the primiparous woman, on the contrary, the integrity of the ring is complete, and the os tincæ may become softened without its orifice being much enlarged in consequence.

We have stated that the whole length of the neck disappears at the last, by being confounded with the cavity of the body. The mechanism of this fusion is very simple; the ring at the internal orifice having at length lost all power of resistance from its ramollissement, opens so as easily to admit the extremity of the finger (see Fig. 42), and this dilatation gradually augments under the influence of those feeble contractions by which the uterus, in the last fortnight of gestation, seems to prelude the labor of childbirth, and as soon as this is sufficiently advanced to permit the inferior part of the ovum to engage in the cavity of the neck, we can understand that the latter is promptly trespassed upon. Again, there is no projection found at the upper part of the vagina, unless, perhaps in those who have had children, a collar of variable thickness and softness, circumscribing an opening large enough to permit the finger to reach the membranes; whilst in primiparæ, only a sharp, thin ring, in the centre of which is a much more contracted orifice, will be encountered.

4. We have but little to remark concerning the situation and direction of the uterine neck during pregnancy, and our opinions do not differ from those held by the majority of writers on this subject; hence we shall merely state, in a few words, that during the first three months the neck is lower, is directed more in front, and a little to the left; and that this position is the necessary consequence of the inverse movement of the body of the organ, by which its fundus is carried backwards into the sacral cavity, and pushed to the right by the tumor, which the rectum, habitually distended with fecal matters, forms behind and at the left part of the excavation.

In the last six months, the cervix, necessarily following the ascent of the body, mounts upward, and, at the same time, most generally looks backward and to the left, whilst the fundus is nearly always carried forwards and to the right.

I cannot pass over, however, a disposition of the neck occasionally met with at the end of gestation, that sometimes embarrasses persons not familiar with this kind of exploration: namely, in the last month, the head (if that is the presenting part) frequently presses before it, in engaging in the excavation, the anterior inferior portion of the uterus, and in case the female has a large pelvis, this descends even perhaps down to the inferior floor. The neck will therefore necessarily be carried behind the tumor which then fills the pelvis, and the plane of its orifice will look towards the anterior face of the sacrum, and, of course, in order to penetrate its cavity, the finger

must be bent like a hook and be introduced from behind directly forwards. This posterior obliquity of the cervix, which differs essentially from that produced by an anteversion of the womb, sometimes renders it very difficult of access, even when the labor is somewhat advanced. The difficulty is still further increased, in some cases, by the softening of the neck throughout, in consequence of which it becomes flattened and applied to this tumor forming a kind of fold or doubling on its posterior part.

Summary.—From what has been stated, we may now draw the following conclusions:

1st. That the tissue of the neck begins to soften at the very commencement of pregnancy, and the softening, although not very apparent in the earlier months, and limited to the most inferior part, gradually ascends, so as to invade successively the whole neck from below upwards, though it is sometimes less marked and less rapid in its progress in primiparæ than in other females.

2d. The cavity of the neck dilates simultaneously with the softening of its walls; and further, this enlargement causes it to be spindle-shaped in primiparæ; and, in females who have already borne children, to resemble a thimble, the finger of a glove, or a funnel with its base below.

3d. The external orifice remains either closed, or else very slightly open, in primiparæ, up to the very term of pregnancy, whilst in others it is widely open, and constitutes the base of the funnel

4th. The whole length of the neck disappears in the last fortnight, being lost in the cavity of the body. The effacement beginning by the internal orifice and gradually involving the neck from above downward as far as to the external orifice.

5th. Contrary to the opinions generally adopted before the time of M. Stoltz's publication, the neck preserves its whole length until the last fortnight; it does not shorten from above downward during the last four months, but the fusion of the neck with the body takes place only within the last few weeks of gestation.

§ 3. Modifications in the Texture of the Uterus.

Among the many changes which the womb undergoes during pregnancy, the most curious of all are those exhibited in its texture; and we shall study these by successively examining the different parts of its constituent elements.

1. *Serous Coat.*—The peritoneum, forming the external membrane of the uterus, spreads out in all directions. The various folds formed by it in the neighborhood of the womb, a species of mesentery, as M. Dubois calls them, such as the broad ligaments and the anterior and posterior ligaments, are double. Many anatomists believe this doubling is even sufficient to accommodate the enlargement of the organ. But, to refute this opinion, it is only necessary to examine that portion of it comprised between the commencement of the two tubes, which cover the fundus; for this will afford a convincing proof that it cannot be furnished by the accession of neighboring parts of the peritoneum, because, as Desormeaux remarks, the insertion of the tube and ligament of the ovary upon each side presents an obstacle that

will prevent the gliding of the adjacent membrane. The peritoneal tissue, however, undergoes a considerable extension, and a more active nutrition must necessarily take place to prevent its attenuation, since that which covers the uterus during gestation quite equals in its thickness the serous membrane of the unimpregnated state. This extension of the peritoneum, without a decrease in thickness, is not a new fact in pathology, and it may be seen in every hernia of considerable size.

The tissue uniting this membrane to the muscular substance appears to have diminished in density; for the peritoneal coat is movable on the muscular walls, according to M. Dubois, who has met with difficulty from this cause every time he has performed the Cæsarean operation.

2. *Mucous Coat.*—Although the existence of this coat in the non-gravid state has been denied by many anatomists, it becomes very apparent during pregnancy. It then grows redder and more vascular, and its folds disappear; but this unfolding will not alone account for the extension which it undergoes, and it must, whatever be said to the contrary, receive, like the peritoneum, a more active nutrition.

All the elements which we have mentioned (page 80) as entering into its composition undergo, in reality, a considerable development. The nature of this work does not allow us to enter into all the details which the subject demands, and we prefer referring the reader to the excellent work published by M. Robin, in the *Archives*, for the year 1848, Vol. XXV. of the *Memoires de l'Académie de Médecine*, and in the *Bulletin de l'Académie de Médecine*, 1861.

The glands of the body of the womb share in the general hypertrophy, and we shall be obliged to recur to this subject when we come to treat of the decidua, which is nothing else, as must be finally acknowledged, than the mucous membrane of the uterus modified by the progress of gestation. (See *Decidua.*)

It is easy to convince ourselves, after the accouchement, that the mucous membrane of the neck itself is also hypertrophied, though much less so than that of the body. Its glands, also, have undergone an enlargement, their secretion is much increased, and to it is due the gelatinous plug, that is to say, the elastic, dense, semi-transparent, and almost insoluble mass of mucus, which closes and fills the cavity of the neck during pregnancy. That such is the case may be demonstrated by examination of the bodies of women who die during pregnancy, when, if the mass be detached, prolongations will be found passing from it, and entering the orifice of the glands. (Robin.)

3. *Middle Coat.*—[The middle coat of the uterus is formed of muscular fibres of organic life, as stated whilst describing the normal anatomy of the organ. In the unimpregnated condition these fibres are hardly recognizable, but during pregnancy they become very evident. Numerous microscopic researches have shed still more light on the subject, revealing the most intimate changes which the muscular tissue undergoes. According to M. Ch. Robin, whose opinion is stated by M. Pajot, the muscular or cell fibres of the uterus are, in the empty uterus, remarkable for their small size and grayish color, making it difficult to distinguish them by the naked eye from the cellular texture which surrounds them. During pregnancy they enlarge in every way, particularly in length, and new fibres are formed beside the old ones, especially in the innermost layers of the middle coat

We quote the text in which Kolliker treats of the subject, viz.: "The muscular coat undergoes an increase in bulk, to which the enlargement of the uterus is principally due, an increase resulting from the concurrence of two phenomena: *the increase in size of the pre-existing muscular elements, and the formation of new ones.* The first of these is so marked that the contractile fibre cells, instead of being from .05 to .07 of a millimetre[1] in length, and .005 in breadth, which is their usual size, measure in the fifth month .14 to .27 m. m. in length, and .0055 to .014 and even .02 m. m. in width; in the second half of the sixth month .2 to .52 m. m. in length, .009 to .014 m. m. in width, and .005 to .006 m. m. in thickness; so that they are about from seven to eleven times longer, and from two to seven times wider than at first.

"*The formation of new muscular fibres* is especially noticed during the first half of pregnancy, and in the internal layer of the muscular coat. In this situation are found a multitude of young cells of from .02 to .04 m. m. in diameter, presenting all the transition forms of cell fibres of from .05 to .07 m. m. in length; nothing similar to this being observable in the external layers.

"This generation of muscular fibres appears to cease at the sixth month; at least I have been able to discover in the uterus during the twenty-sixth week of pregnancy only enormous fibre cells with no traces of preceding forms.

"To this increase of muscular fibres corresponds that of the connective tissue which unites them; toward the end of pregnancy the latter exhibits in some places a distinct fibrillation." (Human Histology.)

In short, the increase in size of already existing muscular elements, and the formation of new fibres, concur in the production of the uterine hypertrophy.

We have next to exhibit the arrangement and direction of the muscular fibres, and in so doing shall state successively the result of the dissections of Madame Boivin and of MM. Deville and Hélie.]

A. According to Madame Boivin, there are two planes of fibres in the body of the uterus—the one exterior, the other interior; the external plane is composed of fibres which run from the middle line outwards and downwards to the inferior third of the organ, where they terminate upon and aid in forming the round ligaments situated there, while the most superior ones are distributed to the Fallopian tubes and the ligaments of the ovary. An exact idea of the radiated disposition of the external fibrous planes, at the superior and lateral parts of this organ, may be formed by imagining the long hair of the human head to be parted along the whole middle line of the cranium, and then combed smooth on each side in front, and tied very tight opposite each ear.

Fig. 43.

Muscular fibres of the uterus. *a a*, The internal orifices of the Fallopian tubes.

Another muscular plane is found internally, having an entirely different arrangement; these fibres are circular and situated at the superior angles of the womb. They surround the internal orifice of the tubes (*a a*, Fig. 43), describing concentric circles, at first very

[1] A millimetre is .0.039 of an inch.

small and close, but gradually separating as the distance from the angles increases, so that the last and largest border upon the median line, and spread out in the direction of its length.

Between these two planes, the external one composed of longitudinal, and the internal one of horizontal fibres, some other muscular fibres are found, the course of which it is impossible to trace.

Only a single order of fibres, which are semicircular, exists at the inferior part. They commence at the median line of this region, and reunite on the sides near the round ligaments.

I will remark, in terminating this short account of the uterine structure, its great resemblance to that of all the hollow organs, in having, for instance, its longitudinal fibres on the exterior, whilst the circular and horizontal ones are internal. The fundus uteri is the part particularly concerned in the expulsion of the fœtus, and it is there also that the muscular apparatus is the most developed; its disposition is such, that all parts of the uterine surface tend towards the centre during contraction. Lastly, at the inferior part, where the resistance should be least, there are only the horizontal fibres, constituting a sort of sphincter muscle, which may be compared, on more than one account, to the sphincter of the rectum or of the bladder.

B. Quite recently, M. Deville, prosector to the hospitals, has studied the muscular arrangement of the uterus in a great number of cases of females who died a few days after labor, and the results at which he has arrived differ much from those previously acknowledged. This subject, in my estimation, requires further examination; but whilst awaiting an opportunity of dissecting for myself, the preparations of M. Deville appear so satisfactory, that I have obtained a drawing of them, and introduce here the description furnished by that skilful anatomist.

Examined on its external surface, after the removal of the peritoneum and the compact resisting layer that separates this serous coat from the muscular fibres, the uterus seems to be composed of two orders of fibres, which are essentially muscular, one being transverse and the other longitudinal.

The transverse fibres *arise* (this word to be received in a purely descriptive sense) from three sources: the round ligament, Fallopian tube, and the ligament of the ovary; also from the wings of the corresponding broad ligament. The mere removal of the delicate peritoneal envelope of these organs suffices to bring the transverse fibres into view, and at the same time to reveal their muscular character.

The transverse fibres, together with certain vessels and nerves, constitute the intimate structure of the round and ovarian ligaments, as also the middle layer of the Fallopian tube, which is therefore essentially muscular, like the internal membrane, improperly called dartoid, of all the excretory canals.

The presence of a great number of transverse uterine fibres lying in the thickness of the folds of the broad ligament, and extending to its base, is an important fact to be borne in mind; and the question arises, where do they terminate? I confess that I have not been able to determine this in a satisfactory manner.

However the truth may be, the transverse fibres coming from these divers origins spread out in a radiated manner over the whole exterior surface of the uterus, the anterior and posterior ones transversely, or a little downwards in an oblique direction, and the superior, obliquely upwards, so as to cover the organ completely. Near the median line these fibres are crossed perpendicularly to their course by a longitudinal fasciculus, more or less sinuous in character, and three-eighths to three-fourths of an inch wide, which arises near the point of union of the body with the neck, ascends upon the fundus of the organ, and descends on the posterior face, to be lost at its inferior part opposite to or a little below the point of beginning, that is, near the union of the body with the neck. A positive continuity will be observed between the transverse fibres of each side and the middle longitudinal fasciculus, if the line of contact be carefully examined.

As the transverse fibres arrive near the median line, some curve downwards, others upwards, so as to become longitudinal, and thus constitute the median layer. This is particularly evident at its termination, both in front and behind, for the whole fasciculus divides there into two portions, one of which curves to the right, the other to the left, and becomes continuous with the most inferior transverse fibres of the body.

This continual exchange of the two series of uterine fibres takes place with such great uniformity, that the longitudinal fasciculus has nearly the same thickness everywhere; but if this lamina be more patiently examined, it will be found to be composed of very short longitudinal fibres, forming the central part of a letter X, which the uterine fibres describe, as I have verified on many of my preparations, in the following manner.

Fig. 44.

The disposition of the muscular fibres on the anterior face of the womb.

Let us take a layer of transverse fibres on the *right* side of the uterus, at the anterior inferior part (see Fig. 44); this fasciculus nearly approaches the median line, then curves upward and becomes confounded with the longitudinal lamina; then, after a vertical course, varying from one-third of an inch to two inches, it again curves to the *left*, to reassume a transverse direction, thus representing a Z, or still more exactly, a branch of the letter X.

Thus, the longitudinal median layer is produced by the union of the central and vertical branches of the X, described by the uterine fibres.

It sometimes happens, however, that the transverse fibres pass directly from right to left without forming the vertical branch, which fact should be borne in mind lest this arrangement existing on the surface might give rise to a belief of the absence of a median longitudinal fasciculus; whereas, if the latter is not evident, it will only be necessary to raise carefully this layer of median transverse fibres, to bring it into view. The uterus exhibits

the same disposition of muscular fibres on the internal face, which will readily account for the error of Madame Boivin, who described them as circular.

Fig. 45.

The disposition of the muscular fibres on the posterior face of the womb.

Notable differences, however, exist between the fibres on the two surfaces of the organ. The most remarkable on the exterior is the extreme breadth of the longitudinal fasciculus, which covers the whole fundus, extending from the orifice of the Fallopian tube on one side to the same point on the other. When this fasciculus reaches the anterior and posterior faces, it is intersected at right angles by the transverse fibres occupying the lateral portions just below the orifice of the tubes, which act there as on the exterior surface: that is, some of the fibres curve upwards, others downwards, becoming confounded with the longitudinal layer. Lower down, near the junction of the body with the neck, the longitudinal fasciculus is very irregular. Sometimes it exists; sometimes, though more rarely, it does not.

At this point, in fact, the continuation, or inter-crossing of the transverse fibres from one side to the other, occurs in an irregular manner, either forming the vertical branches of an X, or taking an oblique direction, or again going directly across, the fibres preserving a transverse course.

Fig. 46.

Shows the inter-crossing of the uterine fibres.

A third layer exists between the two just described, but I am not sufficiently acquainted with the disposition of its fibres to give an exact account of them.

All these particular details do not interfere with the general law of *inter-crossing*, or passage of uterine fibres from one side to the other, and in this respect, the uterus may justly be ranged in the same class with all the other hollow muscular organs whose structure is also regulated by the fundamental law of *muscular inter-crossing*. Hence, it would not be difficult to demonstrate that the human uterus, as just described, approaches in its structure quite as well, perhaps better, to that of the same organ in other mammiferæ, than the arrangement pointed out by Madame Boivin. But such a discussion would be out of place here.

In conclusion, I will observe, that the same dispositions in the muscular arrangement are found in the neck and inferior part of the body. Inter-crossings occur there also, the fibres passing directly from one side to the other, or becoming more or less oblique at the moment of crossing, and still oftener forming the branches of an *x* with the median vertical parts. This last disposition gives rise to the peculiar formation, which has improperly been called the *arbor vitæ*.

[c. Lastly, M. Hélie, Professor in the Medical School at Nantes, has, in a remarkable memoir written after long and skilful dissections, discussed anew the subject of the muscular structure of the uterus.

As M. Hélie seems to represent the true state of the case, and gives a better and more complete exhibition of the arrangement of the muscular fibres than has hitherto been done, we shall follow his description whilst pointing out the principal results at which he has arrived.

The fibres of the uterus, like those of the heart, are disposed in layers, which cover and envelop each other successively. Fibres pass frequently from one layer to the other; their arrangement is intricate, and their dissection very difficult. These superposed layers form the muscular structure of the uterus, and we shall describe successively the external, the internal, and the middle layer.

The *external layer* is composed of several alternate planes of longitudinal and transverse fibres. The most superficial plane is longitudinal, and is formed of a median fasciculus whose middle part is curved like a loop upon the fundus of the uterus, whilst its two extremities descend, one upon the posterior and the other upon the anterior surface of the organ. This loop-like fasciculus (Figs. 44 and 45) always descends further behind than in front. Behind, it begins where the neck joins the body, and is composed of fibres which, from being at first transverse, by a sudden change of direction become vertical, as shown by M. Deville. As it ascends, the fasciculus is reinforced by other fibres bent in like manner. As it approaches the fundus, the lateral fibres curve outward toward the Fallopian tubes and broad ligaments upon which they disappear.

The middle fibres of the fasciculus are, therefore, the only ones which bend over the fundus of the organ, and descending upon the anterior surface curve successively outward to reach the broad and round ligaments.

A portion of the fibres which thus emerge from the loop-like fasciculus, reach the lateral parts of the organ only after having traversed its median line and passed from one side to the other. From the right side, they proceed to the left angle or to the left side of the anterior surface; those, which at their origin belong to the left side, go to the right angle, or to the right side of the anterior surface of the organ.

These crossed fibres follow, therefore, precisely the Z-like direction described by M. Deville. M. Hélie, however, regards the crossings as far from constant, besides being limited to very few fibres; the greater number of the looped ones beginning and ending upon the same side without crossing the median line.

The loop-like fasciculus is almost never limited to one plane only. It is always thick upon the posterior surface of the uterus, sometimes, though rarely, forming a single plane. At other times, and most commonly, its fibres are divided into two planes separated by a layer of transverse fibres, the superficial layer being then thin, and the deeper one much thicker.

Let us study next those transverse fibres which, with the preceding fasciculus, form the surface of the body of the uterus. They constitute the greater part of the external muscular layer, and contribute to the formation of the loop-like fasciculus as already stated; the greater part, however, being foreign to its formation remain upon the median line, passing below it and between its two layers, sometimes even upon its superficial posterior layer. They go from one side to the other, extend outwardly into the broad ligaments, and especially into the ligament of the ovary, the round ligaments, and upon the Fallopian tubes.

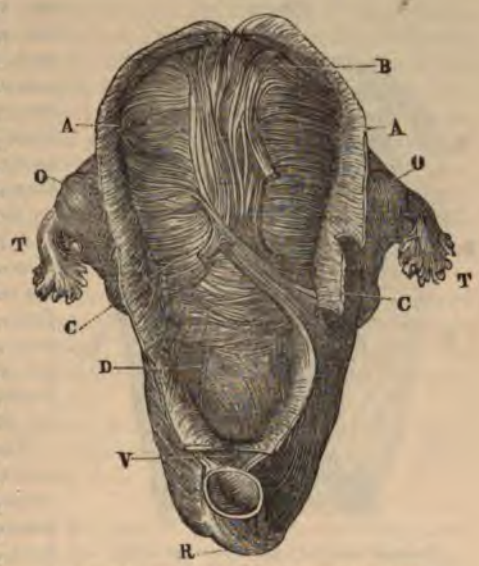
If we follow them in the opposite direction, they may be said to proceed from all these points, and after reaching the sides of the uterus to divide into two layers, one of which passes upon the anterior, and the other upon the posterior surface of the organ, the uppermost covering the fundus and making arch-like curves upon the angles.

Some of the fibres leave the external layer and pass into the middle one.

It should be observed that the anatomists who have studied the muscular structure of the uterus have failed to treat of the sides of the organ, mentioning only those fibres which extend to its annexes; an omission which M. Hélie has supplied.

If the two layers of the broad ligament with the muscular fibres distributed to it be separated, transverse muscular fibres going from one surface to the other, are perceived throughout the entire vertical extent of the sides of the uterus. At the sides of the uterus, these fibres are so curved as to reach the surface opposite to the one from which they took their departure. Such at least is their general arrangement, though their course is a very complex one. They separate to afford passage to the vessels, and do not keep to their primitive plane throughout their course. Thus in front they are superficial, but are more deeply situated behind, and *vice versa*.

Fig. 47.



Second plane of the anterior muscular layer.
A. Superficial layer divided and folded over upon the sides of the uterus. B. Deep layer of the loop-like fasciculus. C. Transverse fibres emerging from the loop-like plexus. D. Fibres of the neck. O. Ovary. R. Rectum. T. Fallopian tube. V. Bladder.

Above, and on a level with the Fallopian tubes, the fibres of the sides of the organ are arranged still differently. The transverse ones which describe large curves upon the fundus from one angle to the other, descend and curve again upon the sides of the organ. A portion of these go to the Fallopian tube, and to the round and ovarian ligaments, the major portion, however, descend upon the sides of the uterus.

In their descent they meet the vessels which interrupt their regularity, then they pass more deeply and curve forward or backward to become transverse upon one surface or other of the organ.

In the neck, the arrangement of the fibres is more simple, for no trace of the loop-like fasciculus is found. Almost all the fibres pass somewhat obliquely downward from the sides of the uterus toward the median line, where they interlace with similar fibres from the opposite side. They pass upon the sides of the neck and curve round from one surface to the other in the same way as on the body, the most superficial passing outward with the vesico-uterine and recto-uterine folds, as also with some fibres of the bladder, and still lower with the muscular fibres of the vagina.

Internal Layer.—When the uterus of a woman deceased just after delivery is opened, the muscular fibres of the body are found deprived of the mucous membrane which had covered them, and which had been transformed into the decidua. As the mucous membrane had not undergone this change in the neck, it there still covers the muscular fibres, and is closely united to them.

When the uterus is opened by incision, the middle of the posterior wall is found to present uniformly a slightly projecting triangular fasciculus, the base of which extends from one Fallopian tube to the other, whilst the apex reaches to the internal orifice of the neck.

This triangular fasciculus is formed as the loop-like one: of horizontal fibres which curve suddenly upward, and what is singular, the new fibres which reinforce it are always added to its left side, whilst from its right side fibres successively emerge which become transverse by passing to the right side of the womb. These fibres have precisely the form of the letter Z.

Fig. 48.

Internal muscular layer. (Anterior wall.)

A. Section of the uterine walls. B. Triangular fasciculi. C. Fibres passing to the Fallopian tubes. D. Openings of the Fallopian tubes. E. Transverse fibres. V. Vagina.

In approaching the Fallopian tubes, the triangular fasciculus divides into two small thin ones, of which one on each side has its acute point inserted into the corresponding Fallopian tube, where it suddenly comes to an end. Finally, transverse fibres extended directly from the orifice of one tube to the other, complete the triangular fasciculus by forming its base. (D. Fig. 48.)

A precisely similar triangular fasciculus exists upon the anterior wall, with the single difference that the transverse fibres whilst curving to a vertical direction enter its right side, whilst from its left side fibres emerge which assume a horizontal direction in order to reach the left side of the womb.

Upon the sides of these triangular fasciculi, throughout the whole vertical extent of the body of the uterus, the muscular fibres of the internal layer have a transverse direction, and pass from one surface to the other. As they approach the middle of the anterior and posterior walls, some undergo an inflexion to form the triangular fasciculus, whilst others in much greater number pass beneath it, and continue their transverse direction. At the internal orifice of the neck the transverse fibres form a projecting fasciculus, which defines sharply the cavity of the body and that of the neck.

At the fundus of the uterus, that is to say, above the orifices of the Fallopian tubes, the muscular fibres form arches directed from before backward, which constitute the vault of the cavity. Descending thus upon the anterior and posterior surfaces, they pass beneath the transverse band of the triangular fasciculus which covers them, and finally curve and become blended with the horizontal fibres.

At the orifices of the Fallopian tubes, the fibres of the internal layer are disposed in concentric rings; the smaller being in contact with the orifice, whilst the larger, often imperfect, are continuous with the arches of the vault, touching back to back those of the opposite side as described by Madame Boivin.

At the neck, it is necessary to remove the mucous membrane in order to see distinctly the muscular fibres. It is then evident that the projection of the arbor vitæ is formed by muscular fasciculi whose fibres separate on each side to form superposed arches. Near the external orifice the fibres of the neck are almost all annular and interlaced.

Middle Layer. — When the progress of the dissection has removed successively the loop-like fasciculus and the different planes of transverse fibres which compose the external layer, the middle layer, presenting an entirely different arrangement, is reached.

Between these two layers, however, there is no precise line of demarcation, the deep fibres of the external layer assuming gradually the arrangement peculiar to the middle layer. Therefore, only after the removal of these intermediate laminæ, can the middle layer with all its peculiarities be clearly distinguished. The same observation applies to its exhibition by the entire removal of the deep layer.

The middle layer, first indicated by the great number of vessels which it contains, is always thicker in the part corresponding to the insertion of the placenta. It is composed of bands of variable width, crossing each other in all directions, some being transverse, others oblique, and some again longitudinal. Large orifices traversed by the veins or sinuses separate these bands from each other or even the fibres of the same band. The muscular fasciculi are curved in loops around the uterine veins, each loop being crossed by another forming with it a complete ring which surrounds the vein; a succession of rings forming a canal for the vein. Large rings produced in the same way inclose several veins, each of which has its special rings within the principal one. Most frequently, the loop-like fasciculus forms but the half or two-thirds of a circle, another fasciculus completing it by crossing its extremities, at the same time becoming closely attached to them.

Each vein is therefore surrounded by annular contractile fibres, and traverses a true contractile canal in its course through the middle layer. The arteries, like the veins, are surrounded by muscular rings, with this difference, however, that the arteries are free within the rings, whilst the veins, reduced to their internal membrane, adhere to the muscular fibres.

According to M. Hélie, the middle layer is found only in the body of the uterus and is absent in the neck. The latter, therefore, is formed simply by the superposition of the external and internal layers.]

4. *Vascular Apparatus.*—Towards the end of pregnancy, the uterus exhibits an astonishing development of its vascular system. My friend, Dr. Jacquemier, has for fifteen years paid much attention to this subject; the results of his labor as found in his work are important, and from them I draw largely. "In studying the development of the vascular system in its whole extent, we shall find," he says, "that the augmentation in the size of the arteries only becomes considerable as they approach the uterus. Whilst advancing between the peritoneum and the external face of the organ, and before giving off their first divisions, they dilate and swell up, and then they furnish branches to the anterior and lateral parts, which ramify *ad infinitum;* they are not situated immediately below the peritoneum, but are separated from it by a delicate layer of muscular tissue. All these ramifications anastomose freely and penetrate through to the internal surface, where they generally terminate; but a large number of those, corresponding to the placental insertion, traverse the mucous membrane and enter the placenta. The ramifications of the arteries are continuous with the capillaries, which in their turn give origin to the veins. That the capillary vessels become enlarged during pregnancy has been proved by Virchow; and Jacquemier found that they were more readily injected than capillaries are under ordinary circumstances. This fact explains the activity of the uterine circulation, as also the rapid and profuse discharge of blood from the arteries into the sinuses.

If the venous trunks be examined, from the point of quitting the uterus to their terminations in the hypogastric vein and in the vena cava inferior, a great increase in capacity will be noticed for the ovarian veins are

almost as large as the external iliacs, and the uterine are but little less. In the substance of the womb, the venous system presents itself as a series of canals, situated in the centre of the muscular tissue, at nearly an equal distance from the internal and the external faces: at this point, the uterus is traversed by a great number of canals coming from all directions, which anastomose, and form large sinuses at their junction; the whole constituting a grand plexus, several divisions of which are large enough to receive the extremity of the little finger.

These canals are much larger opposite the insertion of the placenta than elsewhere, and they diminish in size as they recede from it. There is a certain portion of the uterine walls, determined by the placental insertion, where the venous canals of the uterus traverse the mucous membrane in order to be distributed to the placenta. (See *Decidua* and *Placenta*.) There, in the thickness of the inter-utero placental decidua itself these vessels form, through an enormous dilatation of all their branches, the large sinuses which exist at the adherent surface of the placenta. These sinuses communicate so freely with each other as to form, so to speak, a pool of blood, divided up by numerous partitions. A proportionably small number of orifices exist at intervals, through which this reservoir of blood communicates with the sinuses of the muscular walls. When the after-birth is detached, the whole placental surface of the uterus is found to be riddled with holes, which look as though they had been made with a punch. These orifices, which are oblique, like the section of a quill in making a pen, close of themselves through the depression of one of the membranous lips of the opening against the other. (See *Placenta.*)

When we come to treat hereafter of the decidua, we shall find that the arrangement of the vessels of the mucous membrane properly so called, undergoes changes during the course of gestation; the vascular network of the internal surface, which is highly developed in the early stages, showing signs of a commencing atrophy at the end of the second month, and diminishing to vessels of very small calibre by the end of the pregnancy.

A very delicate yet distinct web of areolar tissue envelops the uterine arteries. The veins, on the contrary, have only their internal coat, which adheres intimately to the muscular substance, and no valves are found in their interior.

So great an enlargement of the arteries and veins must be due to something more than a mere unfolding, since they preserve their flexuosities which are increased rather than diminished. They must, therefore, undergo a change analogous to that which takes place in the fleshy tissue of the organ.

From what has been stated, it is evident that the blood flows to the uterus in very large quantities, and consequently its nutrition is augmented, for such an amount of blood must certainly contribute to the growth of its walls. But the question then arises, is the circulation much more active, as many authors have thought? In reply, it would appear from the late researches of M. Jacquemier, that the venous circulation especially must exhibit an unusual slowness, but I confess the reading of this last part of his memoir has not convinced me on that point. (See art. *Hemorrhage.*)

The lymphatic vessels also acquire a very considerable calibre and form several planes in the uterine substance, the superficial of which are the most developed; they divide into two groups, those of the neck, which run to the pelvic ganglia, and those of the body, going to the lumbar ganglia. The hypogastric absorbent trunks, according to Cruikshank, who has described and figured them, are as large as a goose-quill, and the vessels themselves so numerous, that, when injected with mercury, the uterus appears to be a mass of lymphatic vessels. A common dissection, made a few days after delivery, will afford convincing proofs of their volume and number.

5. The *nerves* of the womb have, of latter time, been the subject of numerous researches, among others, by Drs. Robert Lee, Jobert, Rendu, and Boulard. Agreeably to the latter anatomists, whose conclusions closely correspond with those of the English accoucheur, the nerves are derived from three sources: 1st. From the ovarian plexus — few in number, and distributed to the angles and fundus uteri. 2d. From the hypogastric plexus — these are specially destined to the neck; and 3d. Some filaments of the great sympathetic, which accompany the uterine arteries, and are apparently lost upon the neck and lateral parts of the womb. Among the filaments constituting the ovarian plexus, there are a few which seem to follow the course of the blood-vessels passing near the ovary, and reaching the border of the uterus at its superior part. The filaments then penetrate into its substance along with the vessels, apparently for distribution to the muscular walls.

The hypogastric plexus furnishes some nervous filaments as the urethra crosses its anterior part; these nerves are few in number, and ascend along the lateral portions of the neck (but *not* following the vessels), giving off branches here and there which enter the uterine walls, but M. Rendu has not been able to trace them beyond the neck. These nerves differ essentially from the preceding, both in origin and distribution, for they come from a plexus whose branches are not distributed with the vessels, and which has frequent anastomoses with the sacral nerves or *nerves of animal life.*

The whole body of the uterus, therefore, receives the nerves of organic life exclusively, whilst the nervous apparatus of the neck alone has communications with the spinal nerves. Like the lymphatic and sanguineous vessels, the nerves, according to some authors, undergo a considerable development during gestation. In the preparations exhibited by Robert Lee to the inspection of the Royal Society, and also in the two figures given by him, large nervous bands are seen below the serous tunic, and these bands are so voluminous that many anatomists have doubted their true structure, and regarded them as furnished by a gelatinous or cellular membrane, placed between the peritoneum and the muscular coat. Consequently, in accordance with this view, the uterine nerves do not form an exception, as was for a long time supposed, to the hypertrophy seen in all other parts of the organ during pregnancy — for they likewise are developed in every way, and return after the delivery to their normal size. (See, for further details, the memoir of Dr. Robert Lee, "*On the Ganglia and the other Nervous Structures of the Uterus.*") It is generally admitted, however, that the neurilema is the part chiefly affected by the hypertrophy.

The preparations deposited by M. Boulard in the Museum of the Faculty, and the works of Robert Lee, Ludovic Hirschfeld, and Richet, have convinced us, that exceedingly fine filaments are prolonged even to the lowest parts of the os tincæ, and, consequently, that no portion of the organ is entirely destitute of them.

ARTICLE II.

CHANGES IN THE PROPERTIES OF THE UTERUS.

[*Sensibility.*—The sensibility of the uterus undergoes little alteration. It is well known that in the unimpregnated state the neck may be touched almost without the woman being aware of it, and it may even be cauterized without giving rise to definite pain. The same observation is almost applicable to the organ in the pregnant condition, so that it were wrong to suppose that its sensitiveness is much increased during gestation. The sensibility varies, however, with the cause which excites it; a forced distention, for example, seeming to us to give rise to considerable pain. To avoid exaggeration, it may be said that sensibility exists in the neck, but is obscure during as well as before pregnancy.]

The body of the uterus appears to be even less sensitive than the neck. I am aware that most women feel the motions of the child, but are these movements perceived by the walls of the abdomen, or by the uterine parietes? The fact that in women affected with ascites, the active motions are much more obscure than in other females, tempts us to accept the former hypothesis. I have, besides, frequently known women to pass through the whole course of gestation without feeling the motions; for instance, I saw a patient at La Charité, in August, 1839, who, although advanced to seven months, doubted her pregnancy because she had not felt the child stir. I saw her frequently afterward between this time and near the last of October, when her labor occurred, yet, although the child was quite strong and healthy, she had never observed its motions.

[The body of the womb must not, however, be regarded as entirely insensible, for the contractions of labor or the introduction of the hand give rise to quite severe pain. We shall recur to this subject when studying the subject of the pains of labor. (See *Phenomena of Labor.*)

Irritability.—Having treated of its sensibility, we have a few words to say of the irritability or organic sensibility of the womb, meaning thereby the vital activity peculiar to the nervous system of the uterus, and other parts supplied from the same source.]

This irritability is notably increased during gestation: to it is due the kind of sympathetic relation which is established between the fibres of the neck and those of the body of the uterus, and in consequence of which, any rather active and prolonged excitement of the neck of the organ reacts upon the fibres of the fundus.

Even the premature expulsion of the fœtus is often a consequence of contractions produced by excitations of the cervix, and it is owing to this cause, according to Delamotte, that repeated coition has frequently caused abortion, and that females who are used in our amphitheatres for practising "the touch," are so often delivered before term.

This irritability of the cervix, and its influence upon the contractility of

the body is in some cases turned to profit in the practice of our art; thus it is well known, that one of the surest and most generally employed methods of inducing premature labor, consists in the introduction and retention of a foreign body in the neck of the womb.

[*Contractility.*—By this is meant the power with which the fibres of the womb are endowed of closing upon the body which it contains for the purpose of expelling it from its cavity. It is a true contraction, precisely similar to the muscular contraction of all hollow organs, such as the bladder, rectum, or stomach.

The power of contraction exists even in the unimpregnated condition, especially at the menstrual periods; at which time, in exceptional cases, it gives rise to the severe pain experienced by those who suffer from dysmenorrhœa. During pregnancy, the uterine contractility becomes more evident though still feeble and painless; during labor only does it acquire its full energy, and is then productive of intense suffering.]

The pain which, during labor, accompanies the uterine contraction, is usually very great in the human species, but does not exist at all in wild animals, and is only observed to a very feeble degree in our domesticated ones. As a general rule, the uterine contraction is not painful in the different species of animals, unless an accident or some disease renders a greater energy of action necessary on the part of the organ, and the pains then experienced by the female are altogether similar to those of women.

If, therefore, the contraction is only painful accidentally, as it were, in animals and merely in consequence of a particular morbid condition of the uterine fibre, are we not justified in referring the pain in the human species to the same cause? Now can this predisposition be the result of the refinements of civilization? It would of course be impossible to prove this, but there are strong grounds, at least, for believing that such is the fact, when we reflect that our domestic animals, which, like ourselves, have been translated from their primitive normal condition, often suffer much more during parturition than those in a savage state.

This contractility resides in all the muscular fibres of the womb, both body and neck, though the great development of the muscular layers of the body causes the contraction to be most powerful in that portion. Its intensity is exceedingly variable in different females, being very strong in some, and scarcely existing in others; but its energy bears no relation to that of the external muscular system, for some strong muscular women have extremely weak contractions during labor, and oftentimes the contrary is observed.

The exercise of this function takes place independently of the will, at least in a great majority of cases, which indeed we can readily understand must be the fact, from the origin and nature of the nerves distributed to the body of the uterus, since we have just learned that its fundus receives filaments from the great sympathetic alone. I am well aware the books furnish some cases of women who had the power of suspending the contraction at will; but if the facts have even been well observed, they have failed perhaps to receive the most rational interpretation. In the cases related by Baudelocque and Velpeau, in which the labor ceased when the students were summoned to witness it and began again when these numerous observers retired,

the will had probably less to do than the imagination and modesty, with the alternations of retardation and acceleration; for though the influence of the will may be reasonably doubted, it cannot be denied that moral disturbances appear to affect the contractility of the uterus; thus, a violent emotion has often sufficed to arouse it long before the ordinary term of gestation, and it is not at all uncommon for the contraction to diminish or disappear for several hours, or even days, under the operation of such causes. Dewees knew the pains to be suspended in this manner for two weeks in a woman who was greatly affected by his sudden and unexpected arrival. Betschler cites a case in which the pains were suddenly suspended by a violent tempest, so that the neck, though widely dilated, closed again, nor did the labor recommence until nineteen days had elapsed.

Every day, indeed, we witness a suspension of the pains for half an hour, and sometimes even for several hours, upon visiting women whose modesty is shocked by our presence.

The exercise of this function is seldom of long duration, lasting for a few seconds only—rarely beyond one or two minutes, and then the organ which was so strongly contracted and hardened, gradually regains its primitive state, and remains in repose, until, under the influence of the same stimulus, it is again thrown into action. The organic contractility, like all muscular power, is expended by a prolonged exercise, and hence we can understand why the pains so often become at once more slow and feeble or even cease altogether after a prolonged labor. Lastly, opiates have a marked influence over them; for by employing these preparations, we may suspend the uterine contraction nearly at will, for several hours during labor at term, and indefinitely, in a case of premature delivery or abortion.

This contractility may be excited by natural, accidental, or artificial stimuli: thus, all the causes of labor constitute the first; the second are those of abortion and premature labor; and the third comprise all irritation whatever of the neck or body of the womb; as electricity, ergot, and, in a word, all the means employed when it is desirable to deplete the organ.

On the contrary, it may be weakened by an over-distention of the uterus, by prolonged contractions, or vivid moral impressions.

An observation of M. Brachet's might lead to the supposition that the contractility of the uterus would be weakened, or even totally destroyed, by lesions of the spinal marrow. Experiments upon animals have, besides, shown that complete destruction of the cerebro-spinal axis abolishes the sensomotor functions of the great sympathetic nerve. The uterus would, therefore, be paralyzed in an experiment of this kind. It is, however, proved by numerous cases of paraplegia in females, as well as by experiments on animals, that labor is in no respect impeded by alterations of the cord, that the uterus continues to contract, and that the want of action of the voluntary muscles is largely compensated for by the paralysis of those of the perineum, the slight resistance of which renders the last stage of the fœtal expulsion both more easy and rapid.

This result might indeed have been anticipated from the known absence of all nerves of animal life from the body of the uterus.

The contractility of the uterus, like that of all the viscera of organic life,

is retained for some time after death, and thus serves to explain the occasional expulsion of a fœtus several hours subsequent to the decease of a mother, as also the posthumous contraction of the uterus in Cæsarean operations performed immediately after the mother has expired.

[*Retractility.*—The term retractility seems both to myself and M. Pajot much preferable to that of *contractility of tissue*, by which it has often been designated.

Retractility is a property in virtue of which the uterus, when relieved partly or entirely of its contents, subsides upon itself. It is a sort of elasticity, differing from contractility in being permanent and keeping the walls of the organ closely applied to the ovum, whilst the latter is intermittent and temporary. A principal office of this retractility is that of closing the open orifices of the utero-placental vessels after labor, which without it would give rise to mortal hemorrhage.]

The retractility exists chiefly in the fibres of the body. Dewees supposed it to be seated more especially in the circular ones that constitute the internal plane of the uterine muscular layer, and it is scarcely observable at the inferior parts and in the neck. It was certainly a wise provision on the part of nature to place it in a region where the habitual attachment of the placenta causes a more considerable development of the vascular apparatus. This holds so true, that it is easy to detect the retracted fundus in the hypogastric region after delivery, as a hard, irregular tumor, whilst to the vaginal touch, the neck appears soft, flexible, and not the least contracted. Therefore, whenever the placenta is inserted on the neck, a hemorrhage is not only to be dreaded during labor, but also at the time of, and for a short period subsequent to, the delivery of the after-birth. In most females, the retractility accompanies the contractility, and these two properties are successively in action at the period of labor, and during the gradual depletion of the uterus. In fact, if after the contraction which has caused the expulsion of a certain part of the body inclosed in the uterine cavity, the walls of this organ did not retract promptly to fill up the void, it would constitute inertia of the womb.

The retractility acts slowly and continuously, and is prolonged throughout the period of the getting-up. When it takes place in a regular manner, it is unaccompanied by pain, as we see in the cases of many primiparous women, in whom the retraction is accomplished without their being aware of it.

The retractility is not, however, always equal to this effect, at least during the first days after labor. Its insufficiency may perhaps be due to overdistention, or to a protracted or too rapid labor, in which cases the uterine fibre loses its elastic property, as Leroux expresses it, or else it may be that the presence of a foreign body, whether solid or fluid, requires the intervention of a more active force. Here, then, the contractility is called into exercise, and the retraction of the uterus is effected by a true intermittent and painful contraction.

This diminution of the retractility is generally, however, of short duration, for after four or six days at the furthest, the contractility is no longer required, unless a new clot should happen to form in the uterus. The elasticity of the uterine fibres, assisted by the process of absorption, which goes on unceasingly, and also by the lochial discharge, are thenceforth sufficient to restore the organ to its normal condition.

The retractility is far from being equally powerful in all women, nor is it always easy to give a good reason for the difference. For example, it is much less active in multiparæ than after a first labor, and this explains why after-pains are much more common with the former than in the latter case, for the pains are a consequence of the exercise of the contractility, and the uterus returns more slowly to its habitual volume. Great over-distention of the womb, and a too rapid or too prolonged expulsion, also seem to diminish its action.

If it be indisputable that there are circumstances which diminish the elasticity of the uterine fibres, it is also fully proved that we possess certain agents capable of exciting its action. Thus, external or internal irritations acting on the neck and body (such as cold or frictions), and the administration of ergot, often have this happy effect.

ARTICLE III.

CHANGES IN THE NEIGHBORING PARTS.

We can readily imagine that the modifications just studied do not take place in the uterus without affecting the neighboring parts, and the changes in these will next engage our attention.

1. As the uterus gradually rises in the abdomen, its surrounding peritoneum is carried along with it; the folds, called the *broad ligaments*, then disappear, and consequently the Fallopian tubes and ovaries are drawn nearer to the body of the uterus, where they lie very nearly in a vertical direction; the fundus becomes rounded, its angles diminish and finally disappear. The Fallopian tubes, which in the unimpregnated state are inserted at the apex of the angles, and on the same horizontal line with the fundus, are no longer implanted upon the highest part, but correspond to the upper fourth, or even to the middle of the total length of the organ. The round ligaments are then composed of short linear fibres, among which a great number of muscular ones, prolongations of those of the uterus, and having the same contractility, may be distinguished. M. Velpeau asserts that he discovered and watched their contraction in three different females, during the efforts of the uterus to expel the after-birth. The greater development of the anterior than of the posterior wall of the uterus, removes the insertion of the round ligaments from the lateral position which they occupy in the unimpregnated organ, to a point so much farther in front, that they are implanted at about the union of the anterior fifth with the posterior four-fifths of the antero-posterior diameter.

2. As the womb and upper part of the vagina are intimately associated, the latter is necessarily shortened as the former enlarges in the early periods of pregnancy, whilst the vagina becomes longer when the womb rises above the superior strait. The venous system in the vaginal walls is considerably developed, owing to the greater activity of their circulation. This dilatation of the veins is, doubtless, the consequence of a greater vitality in the genital organs, but it is also due in part to the stasis of the blood, which is impeded in its course by the uterine development.

The varicose state, and the nodosities frequently encountered by the finger on the vulva and vagina towards the end of pregnancy (described

by M. Deneux under the name of *thrombus*), which certainly predispose females to hemorrhagic accidents, may probably be attributed to the same cause; and this congestion even affects the capillaries, for otherwise it would be difficult for me to explain the livid spots or discolorations, resembling wine-lees, presented by the vaginal mucous membrane, and to which attention has again been recently called as affording a sign of pregnancy.[1] But unfortunately this sign can only be serviceable in a medico-legal case, because in private practice very few females would permit such explorations.

In practising the "touch," the finger frequently detects some arterial pulsations at the upper part of the vagina, though they are more frequently found on some point of the supra-vaginal portion of the uterus, and are evidently due to the great hypertrophy of the vaginal and uterine arteries. Doctor Osiander, of Göttingen, attaches great importance to this as a diagnostic sign, and has called it the *vaginal pulse*.[2]

It is not uncommon to find the mucous membrane of the vagina covered, about the seventh or eighth month, throughout its whole extent, with myriads of little pimples as large as a pin's head. These small granulations, which I have frequently met with, always coincide with a marked increase of the vaginal secretion, and have given rise to the term granular vaginitis of pregnant women.

The vaginal mucosities are always secreted abundantly during pregnancy, but the time of their appearance is very uncertain. Usually, however, they are more copious in the advanced stages, and the women then say, "they are losing the milk;" an opinion unworthy of refutation. In some, this flow appears in the early months, then ceases, and again reappears several times; though perhaps not at all, or else only at a very late period.

3. The bladder is gradually pushed above the superior strait, the meatus urinarius is drawn out and elongated, and its orifice, from being so high up, is concealed behind the border of the symphysis pubis, thereby rendering the introduction of an instrument very difficult. The urethral canal is more curved than usual, and the curvature is sometimes so great that the male catheter can more readily be used; because the bladder being strongly pushed forwards, and above the pubis, by the developed uterus, draws this canal upwards, and causes it to be applied against the posterior face of the pubic symphysis, thus producing a curvature of the urethra having its concavity in front. Lastly, as the upper part of this canal is compressed by the enlarged womb, the circulation in its inferior parts is impeded, and the whole tube becomes greatly tumefied. It is placed behind the osseous projection produced by the posterior part of the articular surfaces of the pubis, and these two superposed eminences form a considerable tumor in the

[1] This discoloration is evidently owing to the greater activity of the circulation in the genital organs, and consequently it ought to be met with in all cases predisposing to a vascular congestion of the genito-urinary apparatus. Mr. Montgomery has detected it in a female at the menstrual period, and it is a well-known fact, that cattle-breeders ascertain whether an animal is in heat or not, by examining the orifice and internal surface of the vagina, which is almost as black as ink under such circumstances.

[2] The hypertrophy of the vessels of the vagina and of the vulva sometimes renders wounds of these parts very dangerous. Profuse hemorrhage has been known to occur in consequence of it.

interior of the pelvis. I have frequently known students who were practising the touch, to be unable to explain the remarkable tumefaction encountered by the finger behind the symphysis.

An annoying vesical tenesmus is often produced by the pressure exercised on the body and neck of the bladder, tormenting the female with frequent ineffectual desires to urinate; these demands are always very urgent, and are satisfied by the discharge of a few drops of urine, but are again reproduced with equal intensity some minutes after. Some persons, judging from this frequent micturition, have thought the urinary secretion was augmented.

In certain cases, the swelling of the urethral walls, and possibly also the compression they sustain, produces its complete obliteration and renders catheterism necessary.

M. Velpeau avers, that he has frequently known the bladder, from the fact of its being more compressed above the fundus than below it during the last fortnight of pregnancy, to project into the upper part of the vagina so as to form a true vaginal cystocele. I think. however, that it is of rare occurrence during pregnancy, since I have met with but two instances of it.

4. The pressure of the uterus upon the vascular trunks, which go to or return from the inferior extremities, genital organs, and lower part of the rectum, interrupts the venous and lymphatic circulation in those parts; whence it frequently happens that a considerable œdema of the limbs and sexual organs is produced, as well as the development of some hemorrhoidal tumors.

5. Pregnant women are habitually costive; hence a voluminous tumor is formed at the lateral posterior part of the excavation by the rectum distended with fecal matters. The pressure of the uterus upon the entire mass of the intestines, frequently gives rise to colic and disorders of digestion.

6. The base of the thorax is enlarged and projects in front; the diaphragm is pressed upward by the uterus and intestinal mass, having its concavity increased in consequence; so much so, indeed, as to obstruct respiration, and the circulation in the heart and great vessels.

7. The skin of the abdomen is very much distended, and is marked, especially towards its inferior part, by some streaks of a brown or bluish color, which form parallel curved lines with the convexity towards the pubis and groins. These are very numerous in some women, but in others they scarcely exist; they become paler, but do not disappear altogether after the delivery; sometimes they are continued even to the upper and internal part of the thighs, and not unfrequently involve the skin of the lumbar and gluteal regions.

The muscles and aponeuroses of the abdominal walls become thinner, the recti muscles are removed from each other, and the aponeurotic space which separates them, instead of being a narrow band, as usual, is at least four and a quarter inches wide, on a level with the navel. The umbilical depression, which in the two first months seems deeper, disappears gradually as gestation progresses; the ring becomes distended, and most generally the skin exhibits a protuberance instead of a pit in its place. The eminence is particularly well marked when the female exerts herself, owing to the engagement of a small piece of epiploon in it, constituting a temporary hernia.

Not unfrequently an oblong tumor appears on the median line after delivery, produced by a projection of the bowels in consequence of the great separation of the aponeurotic fibres. The tumor is especially evident during any exertion; and increases in size with each succeeding pregnancy, until it finally becomes an infirmity, which obliges the woman to have recourse to a bandage.

8. The relaxation of the pelvic symphyses is a frequent occurrence; when existing to a great extent, it constitutes a disease that will be more fully detailed in the pathological history of pregnancy.

ARTICLE IV.

CHANGES IN THE BREASTS.

The *mammæ*, which must also be considered as an appendage to the genital organs, undergo, during gestation, some modifications preparatory to the accomplishment of the great function to which they are destined after the accouchement; thus, in the very commencement, most women find their breasts to become tender and larger, and with some, this is so constant a sign that they do not hesitate to consider themselves pregnant as soon as it is perceptible. The enlargement is frequently attended by certain pricking sensations or positive pains, sometimes even by engorgements of the axillary ganglia. It is by no means uncommon for the swelling to diminish towards the fourth or fifth month, but it reappears again near the end of pregnancy, and is then considerably larger than before. In some women it may even be carried to the extent of producing an inflammatory engorgement of its substance, followed by an abscess. More rarely, the breast, which was at first slightly enlarged, subsides, and remains flaccid and soft until after delivery. In general, this is an unfortunate circumstance, because, from the observations of my friend, Dr. Donné, such women prove very poor nurses on account both of the bad quality and the small quantity of their milk.

[When the swelling of the breasts is very decided, it occasions so great a distention of the skin as to give rise to markings which resemble precisely those described upon the skin of the abdomen.]

About the end of the second month, according to Mr. Montgomery, but in my opinion a little later, the nipple swells, and becomes more erectile, sensitive, and projecting; its color also is deeper. The surrounding skin becomes the seat of a larger afflux of liquid, and assumes an almost emphysematous appearance. This skin is also discolored, exhibiting at first a light yellowish tint, but in the course of the two succeeding months the areola is completed, and the skin of the mamma then presents the following characters: A circle around the nipple, the color of which varies in depth of shade according to the individual, being generally darker in persons who have black hair and eyes, and in brunettes, than in blondes, or in feeble and delicate women. The circle is from three-quarters of an inch to one inch and a quarter in extent, but, like the intensity of the discoloration, it increases with the advancement of gestation. In the negress, the areola likewise becomes darker.

FIG. 49.

[A. Nipple. B. Sebaceous tubercles scattered over the surface of the true areola. C. Spots of the dotted areola. D. Markings due to distention of the skin.]

[Here and there on the surface of the areola we find small elevations of about one-sixteenth to three-sixteenths of an inch, due to an hypertrophied condition of the twelve or twenty sebaceous glands already described. When they are pressed, a whitish fluid escapes which has been mistaken for milk.

Toward the fifth month, another areola, known as the secondary, spotted or dappled areola, is formed around the first one. It extends much farther than the first one, often covering a large portion of the skin of the breasts. When this spotted areola is examined closely, we observe that the pigmentary coloration does not cease suddenly at the circumference of the true areola, but that the coloring matter is so deposited in the adjacent skin as to form a vanishing layer of greater or less extent in different women. This secondary areola is sprinkled with a considerable number of small white spots which give it a peculiar appearance. The spots, which have a rounded form, are merely so many points devoid of pigment, each one exhibiting in its centre a small black spot which marks the orifice of a sebaceous gland and the position of a minute hair discoverable by the assistance of a magnifier.]

These changes usually persist during lactation, though when the woman does not suckle her infant they diminish after delivery, but do not wholly disappear. Consequently, they are more conclusive in primiparæ than in others; and although we must not always anticipate their existence in pregnancy, yet, whenever they are found, they constitute an almost certain sign of that condition. (See *Diagnosis of Pregnancy.*)

ARTICLE V.

[ANATOMICAL AND FUNCTIONAL CHANGES OF PARTS NOT IMMEDIATELY CONNECTED WITH THE GENERATIVE FUNCTION.

The entire organism is deeply affected by the pregnant condition. Of the changes observable some are purely physiological and compatible with excellent health, whilst others are pathological. Although indispositions and diseases so often fall to the lot of the pregnant female, it were an exaggeration to say that pregnancy is a disease of nine months duration. Some women are never better than when pregnant, in which case it is eminently a physiological condition.

Although it is difficult to draw the line between these two orders of phenomena, we have nevertheless endeavored to indicate it as clearly as possible, and in this intent shall study at present only such anatomical and functional changes as are observed in healthy pregnant females, leaving all that is pathological for discussion in another part of the work.

§ 1. Digestion. Nutrition.

The digestive organs are almost always affected by pregnancy; but to those functional changes which are familiar to all, we shall add a description of some anatomical alterations of more recent observation.

Disturbances of Digestion. — Sometimes immediately after impregnation has taken place, the digestive function indicates by unmistakable signs the impression produced upon it thereby. We may adopt Professor Pajot's very natural classification of these changes, namely, *stimulation, depression, disorder*, and *perversion*.

Stimulation of the digestive function, says this author, is the least frequent of these classes, though it sometimes occurs. The appetite is then greater, digestion easier, the circulation quicker, the face of a fresher color, and the mucous membranes redder.

Depression of the function is much more common, and is indicated by some emaciation, pallor, and alteration of the features. These are often followed by disorder and perversion of digestion, vomiting being the most noticeable phenomenon of all. Although the latter classes are so commonly attendant upon the pregnant condition as sometimes to have a real diagnostic value, they ought nevertheless to be regarded as diseases, and studied as a part of the pathology of gestation.

Fatty Condition of the Liver. — The liver is found to be increased in size in almost all women who die during or shortly after labor. It was this fact which first drew my attention to this organ, and led me to the discovery of the fatty condition described in my inaugural thesis. The following is a brief statement of the facts concerning it. The color of the hepatic tissue is not uniform, its substance being sprinkled with minute yellow spots so numerous as to give it the appearance of granite. The spots also seem to form so many projecting points, of a size varying from that of a pin's head to that of a millet-seed. Sometimes they are disseminated, at others aggregated, forming in the latter case little insular patches, though sometimes the agglomeration is such as to give rise to a yellow spot of an inch or more in diameter. This appearance is not limited to the surface of the liver, but will be found in any section made through the substance of the organ.

A microscopic examination of this tissue, made in connection with Dr. Vulpian, exhibited hepatic cells in good condition mingled with an abundance of fat globules. A fatty condition of the liver in pregnant women is therefore well determined, although its causes and significance are, as yet, but little understood.

§ 2. Circulation.

Throughout the period of pregnancy, but especially during the latter half, the general circulation becomes more active; an activity which modern research has shown to be connected with important changes in the composition of the blood and with hypertrophy of the heart.

Changes in the Blood. — The conditions known as the plethora and hydræmia of pregnant women have been successively admitted by the profession, but as they involve a question to be studied in connection with the diseases of pregnancy, we here confine ourselves to the statement, that both opinions, though perhaps exceptionally true, are equally false in the majority of cases. Though the blood be altered during pregnancy, we see no reason for regarding the alteration as anything more than a physiological phenomenon.

To MM. Andral and Gavarret is due the honor of having discovered the changes

which the blood undergoes during pregnancy, and their investigations have been followed up by Becquerel, Rodier, and Regnauld. As the experiments of all these observers coincide, we have but to give the results at which they arrived.]

Now, if we admit with MM. Andral and Gavarret, that the mean normal proportion of corpuscles is 127, or with MM. Becquerel and Rodier, that it is 141 for men and 125 for women, it will be seen that all the analyses made up to the present time give a much lower mean for a woman at an advanced stage of her pregnancy. Thus, of 34 bleedings examined by Andral and Gavarret, but one specimen exhibited, at the end of the second month, a proportion of corpuscles greater than the physiological mean, namely, 145. In one only, pregnant between one and two months, did the corpuscles reach the physiological standard of 128. In all the remaining 32 cases the corpuscles were below this point, ranging in 6 cases from 125 to 120, and in the other 26, from 120 to 95.

The 34 bleedings gave different results as regards the fibrin, the mean physiological proportion of which is 3, according to the period of pregnancy at which the blood was drawn. Thus, from the first month to the end of the sixth, the amount of fibrin was always below the average; the mean being 2·5, the minimum 1·9, and the maximum only 2·9. During the last three months, on the contrary, the proportion of fibrin exceeded the physiological average; it was about 4, the maximum reaching 4·8. Toward the end of the last month, the average is 4·3.

MM. Becquerel and Rodier analyzed the blood of nine pregnant women, two of whom were 20 years of age, two 22, one 25, one 27, one 29, one 34, and one 41.

Five of these were of robust constitution, two were about the average in this respect, whilst the other two were weak and apparently lymphatic.

Six enjoyed excellent health, two were not so well, and one was in the hospital on account of indefinite pains in the abdomen, and a cough of rather long standing, though not serious in character.

One was 4 months pregnant, four 5, one 5½, one 6, and two 7.

The following represents the average composition of the blood, at least as regards its principal elements:—

	Average.	Maximum.	Minimum.
Corpuscles,	111·8	127·1	87·7
Fibrin,	3·5	4·	2·5
Albumen,	66·1	68·8	62·4
(The average in non-pregnant women is 70·5.)			
Water,	801·6		
(The average in non-pregnant women is 791·1.)			

My colleague and friend, M. Regnauld, has the following table in his thesis, and I think it so important that I give it entire:—

Table showing the Composition of 1000 *Parts of Blood from* 25 *Women at various Stages of Pregnancy.*

STAGES OF PREGNANCY.	Age.	Fibrin.	Albumen.	Corpuscles.	Solid elements of the serum, less albumen.	Water and volatile matters.
1. 2d month,	20	2·60	70·50	125·35	11·75	789·80
2. End of 2d month,	21	2·80	70·18	126·40	9·30	991·32
3. 3d month,	32	2·70	67·30	122·60	10·20	797·20
4. 3 months,	27	1·98	70·25	126·22	8·65	792·60
5. 3 months ½,	18	2·90	68·09	116·91	11·40	800·70
6. 4 months,	39	2·40	69·35	127·18	10·50	790·57
7. 5 months,	31	2·43	69·40	123·90	8·75	795·52
8. 6 months ½,	29	2·80	68·85	99·76	10·50	818·09
9. 7 months,	27	3·25	69·20	120·40	7·90	799·25
10. 7 months,	35	2·79	68·30	107·92	9·75	811·24
11. 7 months,	22	3·20	68·66	118·40	10·20	799·54
12. 7 months ½,	23	4·16	69·18	99·41	8·43	818·82
13. End of 7th month,	19	3·30	69·07	112·50	9·65	805·48
14. End of 7th month,	25	2·78	65·43	100·77	10·20	820·82
15. Beginning of the 8th month,	29	3·31	66·18	115·44	9·43	805·62
16. Beginning of the 8th month,	38	3·74	64·92	99·36	11·20	820·78
17. Beginning of the 8th month,	20	4·16	67·20	103·40	9·50	815·74
18. 8 months ½,	22	4·47	66·82	95·60	10·95	822·16
19. 9 months,	25	3·70	68·25	108·90	9·85	809·30
20. 9 months,	24	4·89	65·47	91·40	10·75	827·49
21. 9 months,	33	4·42	66·38	115·25	9·24	804·71
22. 9 months,	27	3·69	64·45	90·20	10·40	831·26
23. 9 months,	25	4·39	65·80	94·90	11·65	823·36
24. 9 months,	28	3·86	68·92	102·80	9·96	814·46
25. 9 months,	26	4·28	66·27	99·75	9·80	819·90

The table shows, evidently, that, conformably with the results already mentioned:—

1. *Corpuscles.*—From the beginning of pregnancy, the proportion of corpuscles is sensibly diminished; but that, though the diminution is small for the first five or six months, since it yields an average of 121·04, it is sometimes considerable in the second half, and especially at the end of gestation, at which period the average is 104·49.

2. *Fibrin.*—The proportion of fibrin is not increased in the blood of pregnant women until about the sixth month, but from that time it increases until delivery.

3. *Albumen.*—Like MM. Becquerel and Rodier, M. Regnauld found a decrease of albumen, which is lowered from 70·5, the physiological standard in the non-impregnated condition, to 68·6 in the first seven months, and to 66·4 in the two last.

4. *Water.*—The proportion of water in the blood increases sensibly towards the end of the ninth month; thus, the average of the first thirteen analyses, corresponding with the first seven months, is expressed by 816·01, and that of twelve bleedings performed during the two last, by 817·70.

We would also add with M. Regnauld, that not only is the serum more abundant relatively to the fibrin and corpuscles, but that it contains less solid matter, which of course helps to increase the total amount of water contained in the blood.

[If the blood of a pregnant female be examined by the usual mode of bleeding, a contracted and buffy clot is sometimes obtained, all readily explained by the increase of the fibrin. Still, this appearance is less frequent than has been asserted, and than one might be led to suppose would be the case. Out of nearly two hundred bleedings practised at an advanced period of gestation, M. Jacquemier discovered the buffy coat but once in six, and even then its thickness was very slight. The same author also observed that most of the women whose blood was buffed had fever, and that but few were free from any apparent disease.

The increase of fibrin in pregnant women continues for a certain time after delivery. None of these facts should be forgotten whilst studying puerperal diseases, for without them one would be liable to explain the excess of fibrin by the inflammatory nature of the disease, whilst it is only the expression of a transient physiological condition.

The causes of all of the changes in the blood which we have just studied elude our research. It does not seem to us, however, unreasonable to suppose that the increase of fibrin, by rendering the blood more coagulable, may have a tendency to lessen the hemorrhage which always accompanies delivery. We shall, however, have occasion to revert to this subject.]

Hypertrophy of the Heart.—M. Larcher, long ago (1828), called attention to hypertrophy of the heart as a result of pregnancy; and quite recently, in a paper read at the Academy of Sciences, produced new observations in support of his opinion. According to him, the walls of the left ventricle become at the least one-quarter, and at the most one-third, thicker during the latter months of pregnancy or shortly after delivery; the right ventricle and the auricles preserving their normal thickness. He considers this the cause of the precordial murmur so common during gestation, and the consequence of the obstruction to the flow of blood towards the lower extremities, occasioned by the development of the womb.

[Numerous observations by M. Blot, confirm those of M. Larcher which have just been mentioned. He proved their correctness both by measurement, which is always very difficult, and by weight determined with the greatest care. The results, which he has obligingly put in my possession, are as follows: The total average weight of the heart in 20 cases of puerperal women was about 9 oz. 38 gr. *tr.*, whilst in the usual state the heart of a young woman weighs but from 7 oz. to 7 oz. 2 dr. *tr.* It would thus appear that the organ gains more than one-fifth upon its total weight during pregnancy. This hypertrophy affects the left ventricle almost exclusively, and is remarkable for being temporary like the hypertrophy of the uterus. (H. Blot.)

§ 3. Changes in the Urine.

The urine undergoes great alteration during pregnancy—so that, beside glycosuria, which will be studied in connection with the phenomena observed after delivery, and albuminuria, which properly belongs to the diseases of pregnancy, we have now to treat of kyesteine whose presence in the urine appears to be a result of the pregnant condition.]

Kyesteine.—For several years past the attention of a number of physicians has been directed to the peculiar phenomena exhibited by the urine of pregnant women. Thus, M. Nauche, and after him, Messrs. Eguisier and Tanchou, in France, Dr. Letheby (*London Med. Gazette*, December, 1841), and Mr. Stark (*The Edinburgh Med. and Surg. Journal*, January, 1842), in Great Britain, and Dr. Elisha Kane, in America (*Am. Journal of the Medical Sciences*, July, 1842), have submitted the result of their observations to the public, after arriving at the conclusion that pregnancy may be detected by the inspection of the urine alone. This question, however, is not of such recent origin as many seem to believe, for several of the ancient authors, Avicenna in particular, had previously described the characteristics of this fluid in gestation, and their writings frequently exhibit a special attention to the subject. But we may add, that their observations were far less precise, and, in fact, had become altogether forgotten, when M. Nauche undertook his researches. We shall now present the principal results which have been recently obtained.

If the urine of a pregnant woman be received in a wineglass, and then be permitted to settle in a light, airy place, the following peculiarities will be observed: When first excreted, the urine is acid, whitish, somewhat clouded, and of a nauseous odor; frequently little white corpuscles, readily distinguishable by a glass, are held in suspension, but, in a few moments, these subside in the form of cloudy flakes, either on the bottom or sides of the glass, the urine meanwhile becoming more limpid and transparent. Agreeably to the observations of Dr. Kane, this primary deposit does not always occur, nor is it peculiar to the pregnant state, for it cannot be distinguished from the mucous deposits so often seen in the ordinary urine. No change is visible on the surface during this period, but, in the course of eighteen or twenty-four hours, a number of small, brilliant, crystalline granules, irregularly isolated, appear there, in numerous cases; and in some instances, these granulations unite so as to constitute a thin, transparent, and iridescent layer, which is only visible in certain positions.

The urine remains in that state for several days, though it soon begins to manifest the peculiar signs of gestation; thus, upon the second day, or during the course of the third, according to M. Eguisier, sometimes sooner, but rarely later, its transparency diminishes, the original clouded appearance returns with increased intensity, the odor becomes stronger, and a pellicle may be discerned forming, at first like a nebulous streak, but soon acquiring larger dimensions. All of these characters are more evident on the third and fourth days, and some small debris fall from the pellicle to the bottom of the glass. By the fifth or sixth day the pellicle is almost entirely destroyed; its debris precipitate and form a white crust upon the sediment. It is, however, replaced successively by new pellicles less white than the former, and studded with minute brilliant points having a crystalline lustre; a greenish tint also supplants the milky appearance.

In the succeeding days, as the evaporation of the urine progresses, its turbidity and green color increase; putrefaction commences, and the second pellicle is destroyed to give way in its turn to a third, which resembles more or less that which putrefaction engenders upon ordinary urine.

Dr. Kane, who has observed these changes almost hourly, furnishes the following account of their progress: The pellicle appears at a variable period; I have seen it sometimes at the end of thirty-six hours — at others, as late as the eighth day; it is scarcely perceptible at first, but soon a light cloud of a milky or bluish-white appearance is seen at the centre or sides of the glass; at the beginning, in some cases, it is uniformly deposited on the surface, constituting there a transparent layer, which becomes more and more distinct; at other times, it is not so well characterized in the early stages, presenting only a few striated, irregular circular lines, resembling a web, but these striæ become condensed, and about the fifth day are resolved into a true pellicle. It now presents a creamy, opaline layer, of a light-yellow color, which grows thicker and thicker; its external surface is rendered unequal and ragged by the presence of small granulations, which are whiter in color and crystalline. The pellicle then resembles the layer of fat that floats on the surface of cold broth, and it retains these characters for a long time. On the subsequent days, the sides of the glass are covered with small whitish streaks, varying from a line to a fourth of an inch in extent, which attest the descent of the pellicle during the evaporation. The pellicle, especially when thick, gives off a strong cheesy odor, according to Dr. Bird, and thus facilitates the diagnosis; but Dr. Kane has verified this observation in only seven cases out of twenty-five, and he has not remarked that any relation exists between the thickness of the pellicle and the intensity of the odor.

After standing for several days, the pellicle seems first to give way at the centre, and fissures extend, somewhat later, from this point toward the circumference. Gradually, small particles separate from the debris and fall to the bottom of the glass; the pellicle thus diminishes in thickness, but it seldom disappears altogether before the putrefaction of the liquid takes place; and the primary deposit at the bottom is thus increased by all the detached portions of pellicle, which gradually settle down.

The substance forming the pellicle has been denominated *kyesteine* (from κυησις, εως, gestation), by M. Nauche. The globules, held in suspension when the urine is excreted, gradually aggregate, mount to the surface, and constitute the pellicle above described. This pellicle rarely fails to develop itself in the urine of pregnant women; thus, for instance, in eighty-five cases examined by Dr. Kane, it appeared in sixty-eight with all its characteristics, in eleven it was not well marked, and in six only it failed to appear. One of the last six had a mammary abscess, and was convalescent from typhoid fever; another was very much enfeebled by previous hemorrhages, and only four could be regarded as true exceptions to the rule.

Without denying the existence of the modification which we are studying, I cannot accept the opinion of the American accoucheur in regard to the frequency of its occurrence. With the view of determining this point, I have examined the urine of a great number of pregnant females, and I can certify, that, although it did present the characters indicated in a certain number of cases, yet very frequently, and especially in the later months nothing of the kind was discoverable.

I confess, also, that were I to depend upon the result of my latest investigations, I should be inclined to regard the existence of this pellicle as altogether exceptional in the last six weeks of gestation; for I have examined (September and October, 1849) the urine of fifteen women without observing it. I do not, however, forget that I have, in former years, proved the correctness of the observations of my predecessors, and I am unable to explain this difference in the result of experiments performed in absolutely the same manner. Can it be due, as M. Regnauld supposes, to the preservation of its acidity much longer than usual, instead of becoming alkaline within two, three, or four days, as is customary? I acknowledge that my attention was not directed to this point.

The urine of healthy women who are not pregnant, exhibits nothing similar to this, and if at any time it furnishes a pellicle, it has not the distinctive characters of kyesteine. Some years ago, it was my custom to examine comparatively the urine of non-pregnant females, which I placed in the same kind of vessels, and under the same conditions of temperature and atmospheric exposure; and every time that I met with kyesteine in the urine of pregnancy, that of the other woman presented nothing similar.

In certain pathological conditions, the urine is sometimes covered with a pellicle which might prove a source of error, though some authors have pretended to be able to distinguish it from that which is due to pregnancy. For instance, the pellicle which occasionally forms on the urine of persons laboring under phthisis, articular diseases, vesical catarrh, or a metastatic abscess, does not appear before the fifth or sixth day, that is, at about the period when putrefaction begins, and having once commenced, its development is completed in the course of a few hours; whereas, the true kyesteine appears on the second day, is then developed but very slowly, and apparently quite independent of putrefaction. Again, this latter has a greater specific gravity than that produced by any pathological state whatever.

According to the views of M. Regnauld, which we shall give shortly, it will be seen, that, inasmuch as it is due to the same cause, the pathological pellicle ought to present the same characters, and that writers have been deceived as to the value of the different signs just mentioned.

The chemical characters of kyesteine will serve to distinguish it from all the mucous or albuminous matters found in the urine. These properties, agreeably to M. Eguisier, are nearly all negative; thus, it is neutral, insoluble in alcohol, ether, water, and ammonia, and, unlike albumen, it is not soluble in alkaline fluids, nor, like mucus, in a mixture of soap and ammonia, neither in boiling alcohol and ether like fat. Further, the urine containing it will not coagulate by boiling, as albuminous urine does, but deposits a copious white powder on cooling; nor will it coagulate by the addition of nitric acid.

Kyesteine has, however, many of the properties of these substances; for, being evidently of an organic nature, it is precipitated by the deuto-chloride of mercury, by most strong acids, and the astringent solutions. Finally, in the present state of our knowledge, it must be regarded as a new substance, which is considered by MM. Bonastre and Nauche as gelatino-albuminous. (Eguisier.) We shall find further on, that the researches of M. Regnauld tend to establish the contrary.

[illegible] agree very nearly as to the physical and [illegible] they differ widely in regard to its micro- [illegible] Eguisier, Golding Bird, Kane, and Donné [illegible] number of the globules. M. Simon, who [illegible] the pellicle to microscopic examination, gives [illegible] his researches. It is found to contain the [illegible] matter, formed of small opaque points; [illegible] motion; 3, crystals of ammoniaco-magnesian [illegible] be made at a still later period, it will con- [illegible]

[illegible] the subject to determine is the following: To [illegible] kyesteine in the urine of pregnant females to be [illegible]

[illegible] to prove that it could not result from a par- [illegible] from the functional derangement of the respi- [illegible] modification whatever in the digestive action, or [illegible] the mammary glands, M. Eguisier concluded that [illegible] passage of the amniotic liquor, or a part of its ele- [illegible] he thought that the two following propositions [illegible] detailed in his memoir) proved the correctness of [illegible] satisfactory manner, namely:

[illegible] exhalation and absorption going on upon the [illegible] amnios, the products of which are removed from the [illegible] urinary passages.

[illegible] a certain quantity of the liquor amnii with the urine [illegible] pregnant, confers upon it many of the properties of [illegible]

[illegible] supposition being admitted, it readily explains, he says, [illegible] begins to be charged with it at a period when the [illegible] abundant enough for us to suppose that its passage into [illegible] appreciable; 2, why the kyesteinic characters are not so [illegible] gestation, a period when the liquor amnii is less [illegible] charged with animal matters; and 3, why they suddenly [illegible] evacuation of the waters.

[illegible] not admit this explanation, plausible as it seems; for [illegible] the kyesteine is intimately associated with the lacteal secre- [illegible] attribute it to an admixture of milk with the urine. [illegible] "I have frequently proved the presence of kyesteine [illegible] different periods of lactation, notwithstanding the formal [illegible] Eguisier; for in forty-four nursing women, out of ninety- [illegible] kyesteinic pellicle was developed, with all the characters [illegible] gestation; and it was nearly always in those cases where [illegible] is limited, or rendered difficult by some particular circum- [illegible] which the breasts were consequently more or less engorged, [illegible] appeared in the urine; but it was found much more rarely [illegible] mother nursed her infant, and her breasts were properly [illegible] a word," says Dr. Kane, "the existence of kyesteine during [illegible] and even after the accouchement, up to the establishment of

the mammary secretion; its rare existence during lactation, and its reappearance, when the latter is suspended or impeded, at the time of weaning, for instance, establish an intimate relation between the functions of the mammæ and the kyesteinic urine." Golding Bird, Simon, and Lehman entertain nearly similar views.

An attentive study of the facts pertaining to this subject has led my colleague and friend, M. Regnauld, to the following opinion:

Normal urine holds in solution a certain amount of azotized matter, originating, probably, in an incomplete combustion of albuminous substances, which in the blood are transformed into uric acid, or, by a higher degree of oxygenation, into urea.

Now we may readily assure ourselves, that during pregnancy there is a hyper-secretion by the kidney of an analogous, if not of an identical matter; and it is to the action of the air upon this azotized matter in its abnormal proportions, that the several phenomena before described appear to be due.

The first cloudiness of the fluid is due to the separation of carbonate of lime, formed by the reciprocal reaction of the carbonate of ammonia, resulting from the decomposition of the urea, and of the phosphate of lime which already existed in the urine. In proportion as the decomposition giving rise to ammonia progresses, the fluid loses its acidity, until the brilliant crystals of ammoniaco-magnesian phosphate, which are so readily recognized by microscopic examination, begin to appear upon its surface.

It is singular, that whilst these reactions are going on, such a multitude of microscopic animalcules (vibriones) should be developed in the urine as to cause the whitish layer, when examined with a proper magnifying power, to seem composed entirely of them, in connection with crystals of ammoniaco-magnesian phosphate.

In order to prove that the formation of the pellicle of which we are speaking is really due to the action of the oxygen of the air upon one of the elements of the urine, it will only be necessary to observe what takes place in two equal quantities of the same urine, one of which is exposed to the air, whilst the other is removed from its influence by being placed in an atmosphere of hydrogen, of carbonic oxide, &c. The first will present the characters described, whilst the other will exhibit no such phenomena.

M. Regnauld does not regard these properties of the urine as due to a special matter contained in it, but as a consequence of the presence of an over-proportion of an element which is common to all urine; whence it seems reasonable to suppose, that this excess of azotized matter might exist under other circumstances, and then give rise to the same phenomena.

The period at which the kyesteine appears in the urine of pregnant women, is stated by writers to be exceedingly variable. M. Eguisier says that the characters which we have described usually begin to show themselves in the course of the second month, and acquire their greatest development from the third to the sixth month; after the seventh, they generally decline until the end of gestation, so that in the course of the ninth, and sometimes even of the eighth month, they are hardly more marked than in the second. M. Tanchou has observed them in women who had missed

their courses but once. Dr. Kane saw them on one occasion before the fourth week, once before the fifth week, and often before the end of the third month. (Dr. Elisha Kane, *American Journal of the Med. Sciences*, July, 1842.)

I think that the facts which I have observed, and the details which I have given, justify the following conclusions:

1. That the pellicle described by Nauche is not composed of a matter of new formation.

2. That it is due to an over-secretion of azotized matter which exists in small quantity in normal urine, and to the action of the atmospheric oxygen upon it.

3. That it is far from being always present at any period of the pregnancy, and that it is very rare in the latter months.

4. That it may appear in certain pathological conditions, and then differs in no respect from that which is observed during pregnancy.

[§ 4. Osteophytes of the Cranial Bones.

There is formed during pregnancy, and may be found after delivery, between the internal table of the bones of the skull and the external surface of the dura mater, a newly-formed product which is at first fluid, but grows gradually denser and finally ossifies, thus adding to the thickness of the cranial walls. At first it forms plates of a spongy tissue inclosed between two compact layers. At a later period the plates are no longer separate but unite so as to form a supernumerary bony arch covering the entire dura mater, but growing thinner as it approaches the occipital foramen to which it finally extends.

M. Ducrest describes it as follows. I examined the surface of the cranium of 231 women who died in the puerperal state, and of these 90, or more than one-third, presented the osteophyte. The researches of M. Alexis Moreau, Interne of the Maternity Hospital, give a still larger proportion. Out of 40 crania, he found that 27 presented it to a greater or less degree. On the other hand, not one of 71 cases, 35 being male and 36 female, whose death had no connection with pregnancy, examined either by M. Cossy, hospital Interne, or by myself, afforded a single instance of the affection.

To which then, of these three conditions (pregnancy, the puerperal state, or puerperal disease) can the production of the osteophyte be referred? Sixteen of the women who had it died between three and seventy-two hours after delivery, and in several of these the plates extended throughout the whole extent of the cranium, and resisted the edge of the scalpel almost as much as the original bone. It were difficult to suppose that such extensive formations could have originated and acquired an almost bony hardness in so short a time as two or three days.

As this objection applies equally to the puerperal condition and to the diseases of which the women died, pregnancy would appear to be the only cause of its development. (Ducrest. *Theses de Paris*, 1844, No. 12.)

An anatomical alteration such as this, appearing under the influence of pregnancy and afterward disappearing, is certainly very curious. Though we may fail to determine its causes and importance, its existence is sufficiently proved. It had been, indeed, already described by Professor Rokitansky of Vienna, who also regarded it as peculiar to gestation and not as a pathological condition.

§ 5. Pigmentary Deposits

We have already stated that the breasts acquire during pregnancy a much darker brown color. Other regions then also receive a deposit of coloring matter. Thus

many women will have on the median line of the abdomen a brown streak as dark as the areola, from the $\frac{1}{16}$ to the $\frac{1}{8}$ of an inch in width, extending from the mons veneris to the umbilicus, and sometimes even to the xyphoid appendage. This line, drawn as with a brush, as M. Pajot expresses it, is especially marked in brunettes, in whom, indeed, it is not uncommon to find the entire skin of the abdomen and of the upper part of the thighs of a deep bistre-like hue, and sprinkled with little white spots precisely resembling those of the dotted areola.

The perineum also, and the labia majora almost always have a darker brown color during pregnancy.

In connection with these normal colorations, we might mention other spots which appear more especially upon the face; but as they appear to us rather of a pathological character, we defer their description to a later period.]

CHAPTER III.

OF THE DECIDUA.

[The study of the decidua intervenes naturally between the history of the changes undergone by the maternal organs and that of the development of the ovum. It is now admitted that the decidua is formed of the uterine mucous membrane which undergoes changes, and becoming detached from the womb adheres so closely to the surface of the ovum as to be expelled with it during labor. Although at the outset it belongs to the mother, it is at the last a mere appendage of the ovum.

Before giving the most recent description of the decidua, it will be necessary to state the old and generally accepted theory concerning it, at the same time endeavoring to indicate the cause of the erroneous views entertained by almost all who have investigated its history.]

The Old Theory.—If an ovum which has been expelled intact in consequence of an abortion within the first two months be examined, it will be found surrounded by a sort of pouch with which it lies in contact by nearly four-fifths of its external surface, whilst the other fifth is free, and provided with the floating villi developed upon the vitelline membrane, known as the villi of the chorion.

This pouch, which is pyriform in shape, like the uterine cavity upon which it seems to be moulded, generally presents but a single opening, situated at the apex of the cone, which it represents, and evidently corresponding to the orifice of the neck of the uterus; sometimes, however, I have found it perforated on at least one side at the point corresponding to the opening of the Fallopian tubes.

The walls of this pouch are formed by a membrane known to embryologists as the *decidua*. It has two surfaces, one external and the other internal. The internal surface is smooth, covered with epithelium, and when examined with a lens, presents small elevations, in form not unlike the circumvolutions of the cerebrum, and each furnished with several oval openings. The cavity limited by this surface sometimes contains a mucoalbuminous fluid, and in certain pathological cases, fluid or coagulated blood, though ordinarily they do not exist in it.

The external surface of the decidua may be divided into two portions.

the smaller of which is in contact with the ovum, and surrounds the greater part of its external surface; the other, and by far the larger portion, is entirely free, and must, when the ovum was still within the uterus, have been applied to the internal surface of the womb. This external surface is very irregular, and thickly studded with small and tender filaments.

The portion of this membrane in contact with the ovum, was at first termed the *ovular decidua*, and afterwards, as suggestive of the way in which it was supposed to be formed, the *decidua reflexa;* the other was called the *uterine* or *parietal decidua*, on account of its relation with the wall of the uterus.

FIG. 50.

A section of the womb exhibiting the decidua *in situ*, before the arrival of the ovum (old theory). A. The cavity of the neck. B B. Orifices of the Fallopian tubes. C. The decidua. D. The cavity of the deciduous membrane.

Now, what is the nature of this membrane? What is the mode of its formation? At what period is it developed? To furnish replies to these questions the following theory was imagined, which theoretically furnishes quite a good solution of all the difficulties of the case.

As previously stated, the uterus, like all the other genital organs, becomes the seat of a more active vitality immediately after a fruitful coition; in consequence of which the blood flows there in increased quantity, occasioning a congestion and turgescence of tissue, not far removed from inflammation. This abnormal excitement is always accompanied by the secretion of coagulable lymph, a sero-albuminous fluid, which soon fills up the uterine cavity. In the course of a few days the fluid thickens, and its exterior particles, by becoming more consistent, form a soft pulpy membrane, which lines the whole internal surface of the womb; thereby constituting a true sac, that is in contact externally with the mucous membrane throughout, and is filled by the uncoagulated portion of the fluid. From its position, this pouch must evidently assume the shape of the uterine cavity upon which indeed it seems to be moulded (Fig. 50).

The fecundated ovule does not reach the cavity of the womb until after the lapse of eight, ten, or even twelve days, from the time of fecundation, but the membrane just spoken of begins to form much earlier. The consequence is, that after the ovule has traversed the tube, it finds the internal orifice closed by the decidua, and evidently can only pass between it and the uterus by pushing the membrane before it. From this time, the decidua presents two distinct layers, the most extensive of which lines the internal surface of the uterus, except at the point occupied by the ovum; it is called the *external* or *uterine decidua*. The other, which is pressed inward by the ovule, and is therefore in contact with a greater or less extent of its external surface, is termed the *internal* or *reflexed decidua*, the *ovular decidua*, and the *epichorion of Chaussier*.

These two layers are at first widely separated from each other; but as the ovum increases in size, the extent of the reflected decidua is necessarily augmented and the cavity diminished, so that by the fourth month the latter has disappeared, and the parietal and ovular layers come in contact.

The ovum is in immediate contact with the uterine mucous membrane

by a small part of its surface; all the rest of its external surface being separated from it by the reflexed layer, the cavity, and the parietal layer of the decidua. All the villi of the ovum which are covered by the decidua, after a time become atrophied and disappear; but those which are in immediate contact with the uterus become greatly developed, and contract more or less intimate connections with the innermost layer of the womb, at the point where subsequently the placenta will be developed.

Fig. 51.

The decidua after the arrival of the ovum (old theory). C. The external, or uterine decidua. E E. The internal or reflexed layer. D. The cavity of the decidua. F The chorion. G. The amnion. The other references the same as in the preceding figure.

We see that thus far this hypothesis coincides very ingeniously with the appearances presented by ova which have been expelled uninjured by abortion. It enables us to understand perfectly how that, notwithstanding the complete integrity of the decidua, the ovum is yet covered by it in but a part of its extent.

Subsequently, however, at the autopsies of women who died in the third or fourth months of gestation, a membrane was discovered upon the external surface of the placenta, resembling precisely the parietal decidua, and continuous with it, without there being any discoverable line of demarcation between it and this inter-utero-placental membrane; so that this uterine decidua, which in aborted ova was in contact with but a portion of the surface of the ovum, was found to surround it completely, as the shell incloses the egg of a bird, when opportunity offered for examining it *in situ* in the uterus.[1] This apparent contradiction with the theory was accounted for by the following hypothesis.

The arrival of the ovule does not at once suspend the former secretion in the uterus; and it continues to go on, more particularly from the surface that is directly in relation with the ovum, in consequence of the greater vitality which the latter maintains; and the secreted matter, being precisely similar to that which formed the primitive decidua, thickens in turn, thereby constituting a layer of plastic material, precisely like the first, between the ovum and the womb, which bathes both the chorial and the uterine villosities; and when this deposit finally coagulates, it contributes to the formation of the placental mass, the external surface of which is in this manner necessarily covered by an albuminous layer. This lamina has been called the *secondary*, or the *inter-utero-placental decidua* (*decidua serotina*). Although limited at first to the external surface of the placenta, it soon unites so intimately with the uterine layer of the primitive decidua, that their separation becomes quite difficult at a more advanced period.

[1] In 1851, I exhibited to the Academy of Medicine, and afterwards presented to M. Coste, who has had it engraved in his great Atlas, an aborted ovum, presenting a perfect decidua, surrounding the ovum as the shell surrounds the egg of a bird. The examination of this ovum revealed an arrangement entirely similar to what will be described hereafter from specimens observed in the uterus. This is, I believe, the first perfect aborted ovum which has ever been studied.

According to this view, the decidua serotina and the primitive decidua have a common origin and texture, and only differ as regards the time of their formation.

In adding, finally, that the decidua was by some supposed to be destitute of vessels (anhistous membrane of Velpeau), whilst others considered it to be perforated and traversed by arteries and veins in considerable number, we shall have briefly reviewed the most generally received opinions upon this subject.

With the exception of some disagreement in regard to unimportant details, all authors were unanimous as respects this capital fact, namely, that the decidua is a newly-formed membrane superadded to the uterine mucous membrane, from which, however, it is entirely distinct. So evident, indeed, did this fact appear, that no one, notwithstanding the old assertions of Sabatier, Mayer, Seiler, and Weber, could bring himself to admit that the decidua was only a development of the lining membrane of the uterus. And even at the present time, notwithstanding the numerous preparations of M. Coste (1842), who was the first to sustain the truth of this proposition in France, many honest minds still hold to the theory of Hunter, which I myself supported so long.

In the second edition of this work, after having stated the opinions which have been successively advanced, respecting the origin, nature, and mode of development of the decidua, I said: "I have examined, with M. Coste, several of the preparations on which he relies for the support of his view, that the decidua is nothing else than the uterine mucous membrane itself, which is hypertrophied by the progress of gestation; unfortunately the ovum in all of them had advanced to the third month at least, and it seems to me that the question can only be determined when an opportunity shall be afforded of examining an ovum of not more than five or six weeks. I am, therefore, far from having a settled conviction, though I am willing to confess that the last uterus examined by us together, has singularly shaken my belief on this point of ovology; and this, conjoined with the descriptions given by Weber and Sharpey, restrains me from speaking with the same degree of confidence as formerly. I therefore think it a question requiring further examination." (Page 176, trans. of 2d edition.)

My desires expressed in 1844 have been realized; and, thanks to the kindness of M. Coste, I have had the opportunity of examining an admirable collection of specimens of all ages, which, I take the opportunity of acknowledging, have not left the remotest doubt in my mind, at least as regards the principal fact. I therefore reject the more or less ingenious hypotheses proposed hitherto, — hypotheses which, it is true, were rendered very probable by the examination of a large number of ova expelled by abortion, — and with the sincerest conviction of its truth adopt the opinion, that the decidua is nothing else than the hypertrophied mucous membrane. The evidence of anatomical demonstration is not, however, to be resisted, and I doubt not that all who, like myself, shall have studied the beautiful preparations at the College of France, will be convinced of the error of their views. For the benefit of those who may not have the good fortune to see these prepara-

tions, I think it proper to give further on the description and the figure borrowed from the magnificent atlas which he is publishing.

Present Theory of the Decidua.—The history of the decidua is, at the present time, merely a continuation of the account of those modifications of the uterine mucous membrane, the study of which was begun whilst treating of menstruation. They are, in fact, so intimately connected, that, in order to understand what remains to be said on the subject, it is necessary to recall the condition of the mucous membrane of the uterus at the menstrual period.

Whilst the evolution of the ovarian vesicle is going on in the ovary, the vascularity of the uterine mucous membrane is, as we have stated (p. 95), greatly increased, and the highly congested vessels are discoverable beneath the epithelium. The utricular glands also become visibly enlarged. By this development of its principal elements, the mucous membrane is so thickened, that in consequence of its restriction to the small cavity of the uterus, it is thrown into folds and circumvolutions of variable depth, which are especially well marked at the angles, and give forth secondary ramifications from the sides, so as to occasion some uniformity of appearance. This state of turgescence, and the violet hue which often accompanies it, is maintained, in a greater or less degree, until the ovule is discharged; it diminishes during the last days of the menstrual period, and disappears almost entirely some time after the catamenia have ceased.

But if the ovule, before leaving the ovarian vesicle, or during its passage through the tube towards the cavity of the womb, receive the vivifying influence of the spermatic fluid, the fecundation will maintain and increase the abnormal excitement of the genital organs, produced by the simple development of the Graafian vesicle. Then, instead of subsiding, the uterine mucous membrane becomes still more turgescent, and of a deeper violet color, and the folds and wrinkles increase so as to more than fill the cavity of the organ. Its vessels are engorged and distended to such a degree as to cause small effusions, which are perceptible beneath the epithelium, and also to produce ecchymosis, which give to the internal surface of the uterus a striking marbled appearance.

Notwithstanding this great turgescence, the internal surface of the mucous membrane is smooth and polished, and never presents the villous projections described by Baër, neither is there any fluid secreted, nor any trace of a newly-formed false membrane. The orifices of the glandular tubes, which are much more visible than in the unimpregnated condition, are alone seen upon the surface.

For a short time after it has entered the womb, the ovule is free from all adhesions, but soon becomes permanently fixed at the point where it was arrested at the outset. Before studying the means by which at a later period it becomes adherent to a circumscribed portion of the uterine parietes, let us examine the facts, and see what can be learned respecting the youngest ovules which it has been possible to observe up to the present moment.

In the beautiful Atlas of M. Coste, is figured and described the uterus of a young primiparous woman, who committed suicide about the twentieth or twenty-first day of her pregnancy, and whose body was opened at the Morgue

of Paris. The size of the organ was nearly double that of the normal condition. A longitudinal incision was made through its posterior wall, after which it was opened and spread out, so as to exhibit the whole extent of the cavity. The latter was free as in the unimpregnated condition, and contained no fluid. The mucous membrane was, however, much thickened and tumefied, presented numerous irregular folds, and was furnished throughout with a rich network of vessels. Notwithstanding the general hypertrophy of the mucous membrane, a sort of soft tumor was discoverable, situated on the anterior surface of the uterus between the two Fallopian tubes, as though the membrane were thicker there than elsewhere. (See Plate III, Fig. 1.) Upon incising this elevated portion, the ovum was recognized by the villi of its chorion. The internal orifices of the tubes and of the neck were free and permeable as usual.

Another woman was examined at the Morgue, who had committed suicide about the fortieth day of her pregnancy. The uterus, which was much larger than in the preceding case, was incised longitudinally on its anterior surface, and so disposed as to exhibit the greatest possible extent of the internal surface.

As in the foregoing specimen, the mucous membrane, which was very vascular throughout and greatly hypertrophied, was in some points still more puffed up, and furrowed with folds and wrinkles.

The upper two-thirds of the cavity were occupied by a soft, fluctuating tumor, situated upon the posterior surface between the two Fallopian tubes. Externally, this tumor presented altogether the appearance and organization of the mucous membrane lining the remainder of the womb. The lower third of the cavity was free, so that the cavity of the neck could be entered without any obstacle presenting. The openings of the tubes were also permeable. An incision upon the most prominent part of the tumor revealed a cavity inclosing an ovum.

The most superficial examination of these two pieces convinced us: 1. That the internal surface of the uterus is lined by a thick, soft membrane, which presents numerous wrinkles and folds at several points. 2. That the ovum was situated in the upper part of the womb, and apparently lodged in a cavity perfectly distinct from that of the remainder of the organ.

Now, in order to solve the problem which we are investigating, we shall have to ascertain, first, the nature of the membrane which lines the cavity of the uterus, as also of those forming the walls of the pouch which incloses the ovule.

The decidua with its three parts, (parietal, ovular, and intermediate,) is simply the mucous membrane in a state of hypertrophy. 1. When a pregnant uterus is compared with the description given (page 95) of the changes which the organ undergoes at the menstrual period, it will be readily perceived that the internal layers of the uterus present in both cases the same physical properties, the former being, however, more tumefied, vascular, and folded. It will also be seen, especially after the uterus has been immersed in spirits and water, that the numerous small openings are merely the glandular apertures enlarged, which are observable upon the mucous membrane in the unimpregnated condition (page 80). Finally, the demon-

stration is completed by the researches of M. Robin, showing that this membrane, like that of the unimpregnated uterus, is composed of the same anatomical elements, that is to say: 1, of embryo-plastic elements; 2, of laminated fibres, both in the embryonic state or that of fibro-plastic bodies, and in that of fully developed filaments; 3, of special cells; 4, of an amorphous matter; 5, of glands; 6, of vessels; 7, that it is covered with cylinder-epithelium becoming tessellated during gestation. All these elements are, to be sure, in a hypertrophied and changed condition, but inasmuch as M. Robin has followed their changes step by step, there can be no doubt as to their identity.

2. The ovum is inclosed in a distinct cavity, separated from that of the uterus by a membranous partition, which has to be incised in order to expose it. This is the membrane hitherto described as the *decidua reflexa;* now what is it? It presents, throughout, the characters of the uterine mucous membrane; it has the same physiognomy, the same arrangement, the same vascularity, and the same glandular orifices; only there is upon its most prominent portion a small circular space, around which the vessels disappear. This space, which is whiter, or of a lighter rose color than the remainder, is the largest in the most advanced ovum. The membrane is distinctly continuous with the uterine mucous membrane at its base, and the vessels traversing it are absolutely the same with those which ramify in the latter. Finally, microscopic investigations leave no doubt that the structure of the two membranes is identical. With the same physical qualities, continuity of tissue, and identity of structure, the membrane surrounding the ovum, the *decidua reflexa* of authors, can be nothing else than a portion of the mucous membrane of the uterus.

3. If the ovum be removed from the cavity which inclosed it, the bottom of the latter is found to be lined by a membrane which is thickly sown with anfractuosities or irregular lacunæ of various sizes, in which those villi of the chorion were engaged which subsequently form the placenta. It is the portion of the mucous membrane to which the fecundated ovule adhered at the outset, and is consequently continuous with that covering the parietes, and identical in regard to structure.

Therefore, the ovule, which upon entering the womb lies free in the cavity, becomes, after the lapse of a period as yet unascertained, enveloped by and lodged in a sort of fold of the mucous membrane.

The manner in which this inclusion of the ovule is effected is a subject of hypothesis; for, although the ovule has been observed when free, at the outset, as also when completely enveloped after the third week of gestation, observations are wanting for the intermediate period. Therefore, in the absence of direct information, we give the explanation proposed by M. Coste, and, indeed, it is difficult to conceive how the phenomenon could take place otherwise.

After traversing the Fallopian tube, the ovum escapes from its internal orifice, and falls into the cavity of the uterus. On account of the swelling of the mucous membrane, this cavity is almost obliterated, and the ovule is consequently supported between two opposite points of the hypertrophied and softened membrane. Therefore, it rarely progresses very far, and

the smaller of which is in contact with the ovum, and surrounds the greater part of its external surface; the other, and by far the larger portion, is entirely free, and must, when the ovum was still within the uterus, have been applied to the internal surface of the womb. This external surface is very irregular, and thickly studded with small and tender filaments.

The portion of this membrane in contact with the ovum, was at first termed the *ovular decidua*, and afterwards, as suggestive of the way in which it was supposed to be formed, the *decidua reflexa;* the other was called the *uterine* or *parietal decidua*, on account of its relation with the wall of the uterus.

Fig. 50.

A section of the womb exhibiting the decidua *in situ*, before the arrival of the ovum (old theory). A. The cavity of the neck. B B. Orifices of the Fallopian tubes. C. The decidua. D. The cavity of the deciduous membrane.

Now, what is the nature of this membrane? What is the mode of its formation? At what period is it developed? To furnish replies to these questions the following theory was imagined, which theoretically furnishes quite a good solution of all the difficulties of the case.

As previously stated, the uterus, like all the other genital organs, becomes the seat of a more active vitality immediately after a fruitful coition; in consequence of which the blood flows there in increased quantity, occasioning a congestion and turgescence of tissue, not far removed from inflammation. This abnormal excitement is always accompanied by the secretion of coagulable lymph, a sero-albuminous fluid, which soon fills up the uterine cavity. In the course of a few days the fluid thickens, and its exterior particles, by becoming more consistent, form a soft pulpy membrane, which lines the whole internal surface of the womb; thereby constituting a true sac, that is in contact externally with the mucous membrane throughout, and is filled by the uncoagulated portion of the fluid. From its position, this pouch must evidently assume the shape of the uterine cavity upon which indeed it seems to be moulded (Fig. 50).

The fecundated ovule does not reach the cavity of the womb until after the lapse of eight, ten, or even twelve days, from the time of fecundation, but the membrane just spoken of begins to form much earlier. The consequence is, that after the ovule has traversed the tube, it finds the internal orifice closed by the decidua, and evidently can only pass between it and the uterus by pushing the membrane before it. From this time, the decidua presents two distinct layers, the most extensive of which lines the internal surface of the uterus, except at the point occupied by the ovum; it is called the *external* or *uterine decidua*. The other, which is pressed inward by the ovule, and is therefore in contact with a greater or less extent of its external surface, is termed the *internal* or *reflexed decidua*, the *ovular decidua*, and the *epichorion of Chaussier*.

These two layers are at first widely separated from each other; but as the ovum increases in size, the extent of the reflected decidua is necessarily augmented and the cavity diminished, so that by the fourth month the latter has disappeared, and the parietal and ovular layers come in contact.

The ovum is in immediate contact with the uterine mucous membrane

by a small part of its surface; all the rest of its external surface being separated from it by the reflexed layer, the cavity, and the parietal layer of the decidua. All the villi of the ovum which are covered by the decidua, after a time become atrophied and disappear; but those which are in immediate contact with the uterus become greatly developed, and contract more or less intimate connections with the innermost layer of the womb, at the point where subsequently the placenta will be developed.

Fig. 51.

The decidua after the arrival of the ovum (old theory). C. The external, or uterine decidua. E E. The internal or reflexed layer. D. The cavity of the decidua. F The chorion. G. The amnion. The other references the same as in the preceding figure.

We see that thus far this hypothesis coincides very ingeniously with the appearances presented by ova which have been expelled uninjured by abortion. It enables us to understand perfectly how that, notwithstanding the complete integrity of the decidua, the ovum is yet covered by it in but a part of its extent.

Subsequently, however, at the autopsies of women who died in the third or fourth months of gestation, a membrane was discovered upon the external surface of the placenta, resembling precisely the parietal decidua, and continuous with it, without there being any discoverable line of demarcation between it and this inter-utero-placental membrane; so that this uterine decidua, which in aborted ova was in contact with but a portion of the surface of the ovum, was found to surround it completely, as the shell incloses the egg of a bird, when opportunity offered for examining it *in situ* in the uterus.[1] This apparent contradiction with the theory was accounted for by the following hypothesis.

The arrival of the ovule does not at once suspend the former secretion in the uterus; and it continues to go on, more particularly from the surface that is directly in relation with the ovum, in consequence of the greater vitality which the latter maintains; and the secreted matter, being precisely similar to that which formed the primitive decidua, thickens in turn, thereby constituting a layer of plastic material, precisely like the first, between the ovum and the womb, which bathes both the chorial and the uterine villosities; and when this deposit finally coagulates, it contributes to the formation of the placental mass, the external surface of which is in this manner necessarily covered by an albuminous layer. This lamina has been called the *secondary*, or the *inter-utero-placental decidua* (*decidua serotina*). Although limited at first to the external surface of the placenta, it soon unites so intimately with the uterine layer of the primitive decidua, that their separation becomes quite difficult at a more advanced period.

[1] In 1851, I exhibited to the Academy of Medicine, and afterwards presented to M. Coste, who has had it engraved in his great Atlas, an aborted ovum, presenting a perfect decidua, surrounding the ovum as the shell surrounds the egg of a bird. The examination of this ovum revealed an arrangement entirely similar to what will be described hereafter from specimens observed in the uterus. This is, I believe, the first perfect aborted ovum which has ever been studied.

h. Section of the mucous membrane covering the ovum, exhibiting its thickness relatively to that which lines the remaining portion of the womb.

c''. Internal surface of the flap of the uterine mucous membrane (decidua reflexa) which covered the ovum.

æ. The ovum, with its surface thickly set with short but considerably branched villi, which come into direct contact with the maternal blood.

FIG. 3. The uterine mucous membrane of the specimen represented by Fig. 1, divided on a level with the neck, and seen separately. The blood which distended its vessels having escaped, in consequence of its immersion in spirits and water, the vascular network which it exhibited has disappeared, and permits us to see that its entire surface is perforated with minute openings, which are the glandular apparatus, observable upon the mucous membrane of the uterus in the unimpregnated condition. The portion of mucous membrane beneath which the ovum was situated, is incised as in the preceding figure, but the ovum is here removed, so as to exhibit completely the walls of the cavity which contained it.

f. The cell or cavity which contained the ovum, strewn with anfractuosities and irregular lacunæ, in which the villi of the chorion were inserted.

c''. Internal surface of the flap of mucous membrane which covered the ovum. The same lacunæ are observable in it as on the opposite surface, *f*, but they are smaller, less numerous, and less pronounced.

s. Sections of the venous sinuses of the mucous membrane of the uterus.

t', *t'*. Internal orifice of the Fallopian tubes, rendered visible in the preparation by the greater unfolding of the mucous membrane. There is no indication of their ever having been obliterated.

Description of the Three Portions of the Decidua.—From the foregoing account, it appears that the different portions of the decidua are the result of the successive phases of development of the uterine mucous membrane, and in order to follow with greater ease the metamorphosis of the latter, we shall describe consecutively the three portions of the decidua.

A. *The Intermediate or Utero-epichorial Membrane.*—If, after the removal of the ovum, the cavity which it occupied be examined during the first month, or the first half of the second, a multitude of irregular grooves or lacunæ, of variable size and depth, in which the villi of the chorion were engaged (see Pl. III., Fig. 3), will be perceived upon the mucous membrane which forms its bottom. These lacunæ, into which smaller ones enter, and which are so numerous as to give to this portion of the membrane the appearance of an areolar, erectile tissue, are supposed by M. Coste to be produced by the wearing away, or corrosion of the vessels, which are more hypertrophied at this point than elsewhere, by the invading growth of the chorion; so that the lacunæ, by communicating directly in this way with the subjacent uterine sinuses, permit the maternal blood to flow into the cavity occupied by the ovum, and come into direct contact with the villi of the chorion.

The presence of the ovum determines at this point a considerable hypertrophy of all the elements of the mucous membrane. The corresponding villi of the chorion also become greatly developed, and all together constitute at a rather later period the mass of the placenta. (See *Placenta.*)

B. The *ovular decidua* or *epichorial membrane* presents very different appearances according to the period at which it is examined. Shortly after its formation is completed, that is to say, after the umbilicus is obliterated, it differs in no respect from the parietal mucous membrane: its

uterine surface has the same color, the same thickness, the same profuse supply of vessels, and is perforated in like manner with numerous glandular orifices. Its ovular surface presents at the same period irregular cavities or lacunæ of variable depth, resembling precisely those described as belonging to the inter-utero-placental layer, and which are penetrated in like manner by the villi of the portion of the chorion covering the ovum. (See Pl. III., Figs. 2 and 3.) But as the ovum enlarges, it elevates and extends it, until about the end of the first month, when commencing atrophy is observed at its centre, in consequence of which its vessels and glands disappear, and the whole of this portion of the membrane gradually loses its thickness. (See Pl. III., Fig. 1.) The result is, that, either in consequence of the distention which it undergoes, or of the pressure exerted upon its most prominent portion through the growth of the ovum, a small but gradually enlarging circular space, deprived of vessels, appears in its centre, whilst the remainder of the surface presents the same vascularity as the parietal mucous membrane. This central portion becomes very thin, even at periods when the circumference of the membrane preserves a considerable thickness.

The obliteration of the vessels and the atrophy of the glandules progress from the centre towards the circumference, so that by the third month the epichorial membrane differs so materially from the parietal mucous membrane that, except at the parts adjacent to the points where the two become continuous, the glandular orifices and vessels are no longer discoverable.

The lacunæ described as existing upon the ovular surface, are still further effaced by the atrophy, and as the villi of the chorion, which were inserted into them, can no longer derive thence the means of nutrition, they become useless and atrophied in like manner.

As the development of the ovum progresses, it tends naturally to encroach upon the cavity of the womb, and consequently to bring the epichorion and the uterine mucous membrane nearer together, until, at the end of the third month, the two are in contact. At a rather later period, they become so adherent as to be separated with difficulty.

It is hardly necessary to state, that when thus deprived of its vascular elements, the ovular portion of the membrane can no longer accommodate itself to the distention produced by the ovum, otherwise than by a progressive thinning of the membrane, and that its extreme delicacy in advanced ovums, or at maturity, is to be thus accounted for. It is found, however, even after labor, adhering either to the chorion or to the parietal mucous membrane.

c. The *uterine* or *parietal decidua* retains the characters already described until towards the end of the second month; but from this time it begins to grow thinner, and its numerous and deep folds are gradually effaced. This first period of degeneration progresses, however, very slowly, for at the third month, the state of the membrane is very nearly the same as at the menstrual periods. (Richard. *Thesis.*)

[Together with this atrophy begins also a transformation of the epithelium, which gradually passes from the cylindric to the tessellated form. There is no proof, however, that the prismatic cells assume directly the pavimentous form;

indeed Robin says that, on the contrary, some time after fecundation takes place, the epithelium of the cavity of the body of the uterus exfoliates, as it were, cell by cell, or at the most by little shreds, and is replaced by the pavimentous form.

This metamorphosis of the epithelium is true for both the uterine and ovular decidua, and when the two come in contact, we have, as a result of their adherence, a layer of epithelial cells in the very substance of the membrane. So intimate, indeed, is the adhesion between the so-called uterine and reflected portions of the decidua, that at the time of delivery they seem to form but a single layer.]

From the fourth month, the uterine decidua begins to lose the marks of energetic vitality which had characterized it hitherto, and its external appearance (perforation and vascularity) is altered; it becomes atrophied to such an extent as to be reduced by the seventh month to the one-twenty-fifth of an inch in thickness, and is still thinner at the termination of pregnancy. Though inseparable at the outset from the subjacent tissue, it is now, in a measure, an independent membrane, and may be isolated and detached in strips of considerable size. This ready separation is due, according to M. Robin, to the commencing development, near the end of the fourth month, between it and the muscular tissue of a new membrane, which is at first soft, downy, and homogeneous, the first trace, in fact, of the mucous membrane which is to replace the decidua that falls after labor. It thickens gradually during the latter half of gestation, and lines the internal surface of the uterus, whose muscular fibres are not therefore left exposed by the complete decollation and expulsion of the uterine decidua, which takes place after labor.

[*Of the Decidua at the end of Gestation.*—At the end of gestation the decidua is thin, and of a grayish or rose-colored appearance; it has an areolar texture, and an irregular surface. The outermost of its two surfaces is throughout in relation with the internal walls of the uterus, now covered by the first elements of the newly forming mucous membrane. Its internal surface adheres closely to the chorion, and at the point of insertion of the placenta becomes involved in the structure of the uterine surface of that organ. (See *Placenta.*)

When the after-birth is delivered, a rupture takes place between the mucous membrane of the body of the uterus and that of the neck. The latter remains, whilst that of the body, now the decidua, is expelled with the ovum, of which it forms the exterior envelope.

It is soft and easily torn; and although the vessels which traversed it whilst it adhered to the uterus, are for the most part obliterated and atrophied, some of them may yet be found full of blood. By scraping with the nail, it may be removed in little shreds. Its softness and opacity serve to distinguish it from the other envelopes of the ovum, which are stronger and transparent.

The inter-utero-placental mucous membrane is duplicated, so to speak, by being separated into two layers: the thinner is removed with the placenta, into the formation of which it enters (maternal placenta, see *Placenta*); the thicker remains adherent to the uterus, and is soon blended with the newly formed mucous membrane of the adjacent parts. The inter-utero-placental mucous membrane does not, therefore, entirely fall away; no newly formed mucous membrane is to be found beneath it, so that it cannot be properly called a *decidua.*

If, therefore, we consider the whole uterine mucous membrane at the time of delivery, we find that the portion lining the neck is not detached, and that the greater part of the inter-utero-placental portion remains adherent and assists in the formation of the new membrane. (See *Phenomena appertaining to the lying-in*

state.) The parietal and ovular mucous membrane constitutes the only portion which is wholly expelled and which really deserves the name of *Decidua.*]

From the details into which we have entered, it is evident:

1. That, excepting the membranes proper of the ovum, the *amnion* and *chorion*, the uterus contains none other than its own mucous membrane.

2. That at the moment when the ovule enters the cavity of the uterus, this membrane has throughout a thickness equal to, if not greater than, that which it possesses at the menstrual period.

3. That this abnormal thickness is wholly due to the hypertrophy of its constituent elements, and especially of peculiar cells, as proved by M. Robin.

4. That immediately after the arrival of the ovule, the vitality of the uterus seems to be concentrated, in a great measure, at that point of the mucous membrane where the ovule is arrested.

5. That, as a consequence of this concentration of the vital forces, the point mentioned of the mucous membrane becomes thickened, grows up around the ovule, investing it with a circular ring, which soon incloses it completely.

6. That from this moment the ovule is separated from the uterine tissue by the *intermediate mucous membrane*, and from the remainder of the uterine cavity by the *ovular mucous membrane.*

7. That, after the first month, the ovular mucous membrane becomes atrophied from the centre towards the circumference, loses its vascularity and glandular openings.

8. That this atrophy involves that of the corresponding villi of the chorion, whilst those which are in relation with the intermediate mucous membrane become, like the latter, considerably developed, and subsequently form the placenta.

9. That, from the fourth month, the parietal mucous membrane begins to degenerate, growing gradually thinner, in consequence of the diminution of its tissue, and of the obliteration by atrophy of its vessels and glands.

10. Finally, that a new mucous membrane is formed by which the old one is removed farther and farther from the muscular tissue to which it adhered so closely at the outset, and that after labor it is completely detached and expelled with the ovum.

This exfoliation of the mucous membrane of the uterus after parturition is explained, to a certain extent, by the formation of a new mucous membrane; but it is much more difficult to understand how it should occur in abortions during the early months, when the adhesion between the mucous and muscular tissues is so very firm. It is true, that the exfoliated decidua is much thinner than that which may be observed still adhering to the uterus at the same period, and that we may suppose a part only of the parietal membrane to have been detached.

CHAPTER IV.

OF THE HUMAN OVUM AFTER FECUNDATION

THE human ovule, prior to fecundation and at its full maturity, is composed, as previously stated (page 90): 1st. Of the vitelline membrane, or the envelope. 2d. Of a granular liquid contained in this membrane, and called the vitellus (yolk). 3d. Of a little vesicle inclosed in the first, and situated in the midst of the granular liquid. This is the germinal vesicle, originally discovered by Purkinje, in the eggs of birds, and subsequently proved by M. Coste to exist in those of mammalia. 4th, and lastly. Of the germinal or proligerous spot (*macula germinativa*), which is detached from the clear contents of the germinal vesicle, and is held in suspension in the fluid which the latter contains.

If the ovule be examined several weeks after the fecundation has taken place, it will be found to have undergone some very remarkable transformations; for it is then composed of such different parts, that if comparative anatomy had not furnished us opportunities of observing, step by step, and hour by hour, the divers modifications it passes through before the organization is fully completed, we would not believe it to be one and the same product. Thus, at the end of the second or third week after fecundation, it exhibits some very different elements to the observer: for example, we encounter, in passing from without inwards: 1st. The *chorion*, a thick exterior membrane, studded with numerous villosities. 2d. A much thinner membrane, situated more internally, and designated as the *amnios*. 3d. A more or less considerable space between these two envelopes, that is filled by an albuminous liquid, in the midst of which a little vesicle (the umbilical vesicle) is situated. And 4th. A liquid fills the cavity of the amnios, the quantity varying with the period of pregnancy, and in this fluid is the embryo.

Finally, let us add that the ovule is enveloped nearly throughout by a double membrane, which at first is entirely foreign to, but subsequently contracts intimate relations with it; this is the deciduous membrane. But before studying the constituent parts of the ovum at an advanced period of its development, let us see what is their proper commencement, and how they can arise out of the simple elements that form the ovule prior to conception.

When the ovule has attained its full maturity, the vesicle in which it is inclosed becomes the seat of an excitation which determines there a considerable afflux of fluid, and causes its progressive distention. This hypertrophy may, as we have seen, be either spontaneous, or produced by coition or other venereal excitement. As a consequence of the distention, the vessels on that portion of the vesicle which projects the farthest from the surface of the ovary become atrophied, its walls grow thinner, and soon give way, thereby permitting the ovule to escape, which, in passing out, draws along with it a part of its granular cumulus. The ovum then engages in the tube, whose enlarged extremity had been applied to the ovary. It must not be supposed that the period for the ovule's arrival in the tube is invariable in the same species of animals, and it probably varies in the human race also, though nothing positive is known on that point. Pending

its stay in the ovary, the ovum underwent no appreciable modification but as soon as it enters the oviduct, the beginning of those changes it must necessarily pass through, in order to give birth to a new being, is observed, and hence, to study these modifications in due course, we must first examine those manifested in the tube, and then such as do not appear until after its arrival in the uterine cavity.

ARTICLE I.

CHANGES OF THE OVUM IN THE TUBE.

It has heretofore been always impossible to study these changes in the human ovum, and the description we are about to give is the result of observations made on the ova of mammalia, especially of the dog and rabbit; but analogy favors the belief that similar phenomena take place in the human species; indeed, the strongest resemblance exists between the ovum of the latter, and the unfecundated ovum of a bitch; besides, the youngest ova that have been studied in the female, exactly resemble those which have arrived at a certain degree of development in animals. It is, therefore, extremely probable that if they are endowed with the same organization before conception, and still exhibit a perfect resemblance after the fecundation, they must have passed through similar successive transformations. From analogy as well as observation, it is supposed that in the human female ten or twelve days are occupied in the passage of the ovum through the tube.

[*Disappearance of the Germinal Vesicle.* — By the time the ovum has reached the oviduct, it has become impossible to find in it either vesicle or germinal spot; and this disappearance of the vesicle and of the collection of granules at its centre, constitutes the first change perceptible in the ovum subsequent to its departure from the ovary.

The disappearance shows that the ovum is mature, but occurs independently of fecundation.

Condensation of the Vitellus. — During the early part of its passage through the tube, the vitellus becomes more dense (Bischoff) and compact, in consequence of which it no longer fills the vitelline membrane, but leaves an intervening space occupied by a clear and transparent fluid. So great is this condensation, that if its envelope be opened, the vitellus is found to be a solid body, capable of division by means of a very fine needle into two, four, and six portions. (See Bischoff's *Atlas.*)

Appearance of Polar Globules. — Succeeding the disappearance of the germinal vesicle and during the condensation of the vitellus, there is formed on the surface of the latter a transparent globule, $\frac{1}{500}$ of an inch in diameter, to which the name *polar globule* has been given. From the point of its formation and during the time of its appearance, there is a retrocession of the granules of the vitellus and consequent separation from the hyaline and transparent substance which united them. It would thus seem that the polar globule is produced by a sort of exudation or accumulation of the hyaline substance of the vitellus, and the point at which it is formed indicates where will take place the first furrow of segmentation, and where at a later period the cephalic extremity of the embryo will make its appearance.

Within a few minutes after it is first perceived, the polar globule constitutes a hemispherical projection on the surface of the vitellus, and finally separates from, and remains simply contiguous to it.

In some species of animals, two, three, or four polar globules are thus successively produced, all taking their origin from the same point. When the last of them is formed, all unite to form a single one, which soon exhibits distinctly an investing membrane and a cavity.

The polar globule thus produced remains beneath the vitelline membrane and unconnected with the phenomena which are to take place in its vicinity. It becomes useless, in fact, as soon as formed, being intended only to prepare the way for the segmentation of the vitellus, which we are soon to study.

Whether fecundation has occurred or not, the germinal vesicle disappears, the vitellus condenses, and the polar globules form; but the changes which we are next to study take place only in fecundated ova. (Memoirs of Prof. Ch. Robin.)

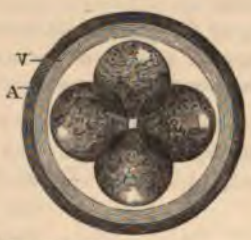
Formation of the Vitelline Nucleus and Segmentation of the Vitellus. — Both the layer of albumen which surrounds the fecundated ovum, and the vitelline membrane become thicker during the passage through the second half and internal third of the Fallopian tube; but the most remarkable changes take place in the vitellus (Barry, Bischoff, Robin).

Whilst the vitellus is undergoing its condensation, a clear spot appears in its centre and increases so rapidly in size by crowding aside the vitelline globules, that in about one hour it has attained a diameter of from $\frac{1}{125}$ of an inch to the $\frac{1}{18}$ of an inch (Robin). The spot is called the *vitelline nucleus*, and has nothing in common with either the germinal vesicle or the polar globule. It is composed of a thick fluid without a cavity or distinct walls.

The vitelline nucleus has barely attained the above-mentioned diameters before it is seen to become elongated and constricted near the middle, and finally separates into two halves. This separation is the signal for the segmentation of the vitellus which itself divides into two halves, in the centres of which are found the corresponding halves of the vitelline nucleus.

Fig. 52.

Fig. 53.



A. The layer of albumen. V. The vitelline membrane.

Each half of the vitellus divides in its turn into two parts and so successively, until by the process of subdivision the entire vitellus (which at first presented two regularly rounded portions (Fig. 52), then four (Fig. 53), and then eight, &c., the vitelline spheres becoming more numerous and smaller) acquires the appearance of a mulberry; whence is derived the name muriform body (Fig. 54) applied to the vitellus after the segmentation is completed.

Fig. 54.

The Fecundated Ovum at a more advanced stage.

A. The albuminous layer surrounding the vitelline membrane V, which is seen to be thickened and to contain within its cavity the mulberry-like mass.

The segmentation of the vitellus would seem to be dependent upon the segmentation of the vitelline nucleus, a portion of which is found in the centre of each vitelline sphere.]

The time necessary for the ovum to traverse the tube is very variable in different animals, and even sometimes in the same species; thus, according to M. Coste, the ovum of rabbits does not reach the uterus before the third or the fourth day, whilst in the bitch, it has been

found in the tubes as late as the tenth, twelfth, or even fifteenth day; and we have formerly stated that, in the human species, no one case has ever proved its existence in the womb prior to the twelfth day. However, it is well to remark, that, as a general rule, the passage is very rapid through the external half of the tube, whilst its progress through the second half and especially through the last third is exceedingly slow, in consequence perhaps of the extreme narrowness of this portion of it.

Finally, the ovum augments somewhat in volume during its course, being probably nourished at first at the expense of the granulations which accompany it, and subsequently by absorbing the albuminous liquid secreted in the oviduct itself.[1]

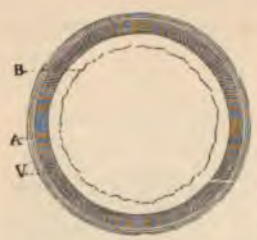
ARTICLE II.

MODIFICATIONS OF THE OVULE FROM ITS FIRST ARRIVAL IN THE WOMB UNTIL AFTER THE DEVELOPMENT OF THE ALLANTOIS.

[*Formation of the Blastodermic Membrane.* — At the time of its entrance into the cavity of the uterus, the ovum is, therefore, composed of the muriform body, the thickened vitelline membrane, and a thin layer of albumen surrounding the latter. Each little sphere of the muriform body now undergoes an internal change by which its outer portion is transformed into a membrane, so that each segmentary sphere represents a cell with a homogeneous envelope and granular tissue. Shortly after this, fluid collects in the centre of the muriform body and presses to the circumference the spheres or cells of which the body had been composed. In consequence of this pressure the cells become flattened and applied to the vitelline membrane so as to form a sort of lining thereto, and by their mutual adherence form a second membrane enclosed within the primary one.]

This second membrane is not easily recognized; but if the example of M. Coste be followed, and the ovule be placed in water, it will become quite apparent. In fact, a very curious endosmotic phenomenon then takes place; the water passing through the vitelline membrane detaches the second vesicle in such a manner that the latter, being completely isolated, as also puckered and corrugated in every direction, floats or hangs suspended in the new liquid which distends the vitelline membrane; and to this M. Coste has given the title of the *blastodermic membrane.* But while this blastodermic vesicle, or membrane, is being developed, the layer of albumen which surrounds the ovum on its first arrival in the uterus, disappears and consequently the vitelline vesicle loses much of its thickness.

FIG. 55.



The ovule shortly after its arrival in the womb. A. The diminished albuminous layer. V. The vitelline membrane. B. The blastodermic membrane.

Hitherto, the ovum still remained free and without any adhesion to the uterine walls; but

[1] This layer of albumen which surrounds the ovum of the rabbit and of the roebuck, whilst it remains in the tube, does not exist around the ovum of the bitch and of the sow. On account of these differences, it will remain uncertain whether it envelops the human ovum until observations which, as yet, it has been impossible to make, shall settle the question.

it commences about this period to contract more intimate relations with the latter, and hence can no longer be displaced by blowing upon it. At the same period a rounded, whitish spot begins to appear on some point of the blastodermic vesicle, which seems to be detached, or to stand in relief; this has been called the *tache embryonnaire* (the embryonic spot) by M. Coste, and it, like the blastodermic vesicle, is composed of cellular granulations, excepting that these latter are more contracted, and are aggregated in a larger quantity at this point. (Figs. 56 and 57.) At the same time, a

Fig. 56. Fig. 57.

Fig. 56. The blastoderm, with the embryonic spot seen in front. V. The vitelline membrane. E. The external layer of the blastoderm. F. The embryonic spot.

Fig. 57. The same figure in profile, to show the two layers of the blastoderm. V. The vitelline membrane. E. The external; and I, the internal or intestinal layer of the blastoderm.

minute examination is all that is necessary to convince us that the vesicle, as also the embryonic spot, is composed of two laminæ, lying in contact with each other, but which may be separated by a couple of fine needles. To render this doubling of the blastoderm more evident, we present two theoretical figures, exhibiting it at the same stage of development. In the first (Fig. 56), which is a front view of the ovum, the blastoderm with the rounded embryonic spot is seen. The same figure, in profile (Fig. 57), shows the two blastodermic laminæ, both presenting a swelling near the embryonic spot. One has been called the *external*, *serous*, or *animal* layer, and the other is denominated the *internal*, *mucous*, or the *vegetative* one. Shortly after this period, the embryonic spot enlarges by the further addition of granules, but more in one of its diameters than in the others, so as to exchange its rounded for an elongated form.

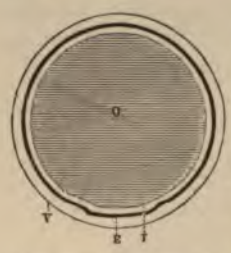
A considerable projection above the external face of the blastoderm may be simultaneously noticed, which exhibits a convexity towards the vitelline membrane and a concavity looking to the central part of the ovum (Fig. 58); and thenceforth the cavity of the blastodermic vesicle is divided into two distinct portions, the one embryonic, the other, which is the larger, forming the umbilical vesicle.

A line of greater obscurity may soon be recognized at the centre of this spot, being the first trace of the embryo. The margins of this spot fold inwards, as do also the extremities, thereby giving rise to an elongated body curved like a boat with the ends swollen, in consequence of their doubling up, and a cavity of some depth at its centre. The body of the embryo is then readily distinguished.

The extremity that is most swollen is called the cephalic, and the other, or less voluminous one, the caudal extremity; about that time the serous

laminæ of the blastoderm can be traced as continuous with the most external layers of the embryonic body, whilst the mucous one forms its internal plane. In proportion as the embryonic spot loses its distinctive characters, numerous little elevations, irregularly scattered over the external surface of the ovum, are seen to develop themselves, being, in fact, the commencement of those villosities which subsequently stud the exterior surface of the chorion.

FIG. 58.



A section of a more developed ovum, in which the two portions, the embryonic and the umbilical vesicle, begin to appear. O. The umbilical vesicle. I. The internal layer of the blastoderm. E. The external layer. V. The vitelline membrane.

During the progress of these phenomena, the external, or serous layer of the blastoderm (Fig. 59) forms a fold around the part which has been transformed into the embryo, and curved as already stated; the fold of the serous layer being especially so at the caudal and cephalic extremities. The fold gradually enlarges above, below, and on the sides, in such a manner as to form a true hood over the head and caudal termination; hence named from this resemblance the cephalic and caudal hoods. These folds elongate rapidly (Fig. 60), passing along the dorsal regions of the embryo, and ultimately coming into contact on the median line, unite so as to form a pouch surrounding the embryo, and continuous with it along the whole circumference of its large ventral opening. Although at first almost in direct contact with the embryo, it is soon after separated from it by a certain quantity of liquid, becoming its immediate envelope, and receiving the name of the *amnion*, and the interposed fluid, that of the *amniotic liquor*.

FIG. 59.

A section showing the origin and first traces of the amnios. O. The umbilical vesicle. I. The intestinal; and E, the external layer of the blastoderm. V. The vitelline membrane. c c. Origin of the cephalic and caudal amniotic hoods.

As to the external layer of the fold, it is manifestly continuous with the serous lamina of the blastoderm, and although primarily applied to the preceding, it is speedily separated therefrom by the interposition of a liquid which removes them farther and farther from each other, until at last its exterior face is brought into contact with the vitelline vesicle. According to some authors, these two become confounded, and by uniting form the outer membrane of the ovum; but others teach that the vitelline vesicle will be gradually absorbed (as we have endeavored to represent in the plates Figs. 61, 62, and 63), while the external lamina of the blastoderm is being developed, and the latter alone will then constitute the enveloping membrane.

At the point of junction, the cephalic and caudal hoods constitute, by their union, a kind of membranous bridge, which there joins the amnios to the chorion. This bridge is gradually absorbed, and the two membranes become completely isolated. (See Figs. 61 and 62.)

Such is the view most generally received on the mode of formation of

the amnios. We must mention, however, one other, which, without being new, has latterly acquired considerable importance by the discussions which it has created at the Academy of Sciences.

We have just seen that the amnios is directly continuous at the umbilicus with the abdominal walls of the embryo, which is in fact so manifest, that no just ground of belief is afforded that the latter was ever independent of the amnios, as some have recently supposed. Messrs. Oken, Pockels, Serres, and Breschet have endeavored, notwithstanding, to prove that the amnios once existed as an independent vesicle, distended by a fluid; and that afterwards the fœtus, by coming into contact with it, caused its depression, and became enveloped by it, like a double night-cap, but having no other relation with it than that of simple apposition; or, in other words, that the amnios had the same connection with the embryo as the serous membranes with the viscera they cover.

Fig. 60.

The amniotic hoods more developed. o. The umbilical vesicle. I. The internal or intestinal; and E, the external layer of the blastoderm. E′. A portion of the external layer converted into the amnios. E″. The embryo. c. The limit of the amniotic hoods. v. The vitelline membrane.

Messrs. Coste, Velpeau, and Bischoff have combated this view successfully, in my estimation, by contending for the existence, at all periods, of the continuity we have just described, and they cannot possibly admit an opinion which is founded solely on pathological alterations. For my own part, after examining the preparations of M. Coste, I can have no doubt as to the little value of such assertions.

Fig. 61.

This figure shows the amnios almost completed, and likewise the origin of the allantois. o. The umbilical vesicle. I. The intestines. E. The amnios. E′. The external layer of the blastoderm, or the non-vascular chorion. v. The vitelline membrane. c. The amniotic hoods ready to close up. A. The allantois.

Immediately after the amnios is formed, the margins of the embryonic spot, and especially its true extremities, become more and more turned inwards, thereby augmenting the concavity which it previously exhibited; and at the bottom of the groove thus constituted, the mucous lamina of the blastoderm is observed to concur in forming the intestinal canal, which is represented at this early period by an elongated gutter, communicating freely with the interior cavity of the blastoderm. But, in proportion as this constantly increasing inversion of the lateral walls, and of the extremities of the embryo, progresses, this communication becomes more and more contracted, so that in a short time the intestinal cavity only connects with the blastodermic vesicle by a contracted pedicle; and thenceforth, this latter receives the name of the *umbilical vesicle*, and the vessels which are

distributed to its vascular layer, consisting of two veins that enter, and an artery that emerges from the embryo, are called the *omphalo-mesenteric vessels.* (Fig. 61.)

As the contraction of the ventral opening in the embryo, and the circumscription of the umbilical vesicle go on, we may observe at the inferior part of the intestinal canal, just in the region where the bladder and rectum, during the earlier days of embryonic life, are confounded under the name of *cloaca;* we observe, I repeat, the intestinal parietes to form there a slight elevation. Now, this little tumor (Fig. 61) gradually elongates, so as to constitute a minute vesicle, which communicates by its narrow pedicle with the intestinal cavity; this is the *allantois,* which has been known for a long time to exist in mammalia, but which M. Coste was one of the first to detect in the human ovum. The allantois is scarcely formed before it is provided both with venous and arterial vessels, consisting of the two *umbilical arteries,* and one *umbilical* vein; the former arising from the primitive iliacs, the latter going to the liver, as may be seen somewhat later.

Fig. 62.

This figure shows the rapid progress of the allantois, and how it spreads over the fœtus, the umbilical vesicle, and the amnios. This latter begins to ensheathe the pedicle of the umbilical vesicle and that of the allantois in such a way as to form a commencement of the cord. The vitelline membrane disappears more and more. o. The umbilical vesicle. E'. The amnios. E''. The external layer of the blastoderm. c. The point where the two hoods come into contact. v. The vitelline membrane almost entirely atrophied. A. The allantois.

This little vesicle passes through the umbilicus at first alongside of the pedicle belonging to the umbilical vesicle, and soon undergoes a rapid development. The growth of the allantois and its vessels is so rapid that it soon comes into contact with the external membrane of the ovum. In some animals, the allantois comes into juxtaposition by its base with only one point of the chorion, and becomes attached there; and then the terminal extremities of the umbilical vessels not only reach this membrane, but even extend for the most part to the villosities developed on its external surface, and acquire there a considerable growth.

In others (see Figs. 62 and 63), the allantois spreads out like an umbrella around the embryo and umbilical vesicle, and supplies itself to the whole external face of the amnios, as well as to the internal one of the chorion, then the two laminæ are fused into each other in such a way as to leave no trace of the allantois. (Figs. 62 and 63.)

The development of the allantois completes the essential part of the ovum, although by reference to Fig. 55, Plate IV., it will now be found to consist: 1, of the embryo; 2, of a variable quantity of liquid in which it swims; 3, of the amnios, already considerably distended, and forming a sheath to the parts that pass through the ventral aperture; 4, of the umbilical vesicle situated between the amnios and chorion, whose delicate pedicle,

with the omphalo-mesenteric vessels appertaining to it, however, still communicate with the intestinal cavity; 5, the pedicle of the allantois vesicle still charged with the umbilical vessels; 6, the space between the amnios and chorion, partly occupied by the umbilical vesicle, but principally filled with a liquid called by M. Velpeau the *reticulated* or the *vitriform body*, according to the degree of its consistence; and 7, of the outer envelope, or the chorion.

The phenomena yet to be studied have special reference to the enlargement of the ovum, and the development of the embryo.

Fig. 63.

In this figure, the allantois has spread over the whole internal surface of the ovum, and but very slight traces are left of the continuity between the amnios and that part of the external layer of the blastoderm which formed the non-vascular chorion: the amnios incloses the umbilical cord more and more. o. The umbilical vesicle. E′. The amnios c. The point where the two hoods are fused into each other, and form but a single membrane. E″. The external layer of the blastoderm. A. The allantois. V. The vitelline membrane.

ARTICLE III.

OF THE FŒTAL APPENDAGES.

These comprise the *allantois*, the *umbilical vesicle*, the *amnion*, and the *chorion*.

§ 1. Of the Allantoid Vesicle.

By the time the amnion has become a completely closed sac, a little pyriform vesicle, which we have denominated the *allantois*, is observed, about the tenth day, to spring from the inferior part of the intestinal canal, and taking on a rapid growth soon becomes applied by its base to the internal surface of the chorion. The terminal branches of the two umbilical arteries and vein, as previously stated, ramify on the walls of this vesicle; and hence the urachus, which is nothing else than the pedicle of the allantois, is accompanied in its course by three blood-vessels (see Fig. 3, Plate IV.), two of which (*i i*) are arterial, coming from the iliacs, and called the *umbilical arteries*. They run to the chorion, where they ramify, and ultimately reach the villi that form the fœtal placenta. The third trunk is venous, and is known as the *umbilical vein*.

The umbilical vein *j* leaves the right auricle of the heart at the point *j′*, and soon after receives the contents of the vena cava inferior *k;* it then traverses the under surface of the liver *m*, to which it sends a copious vascular supply, and, before passing this organ, receives the omphalo-mesenteric vein at the point *o;* then, after leaving the liver, it gains the left side of the abdomen between the walls of this cavity and the intestinal fold E;

next, by turning abruptly towards the umbilical cord, it gets to the left side of the urachus, and accompanies the latter to the chorion, where it follows the umbilical arteries into the villosities.

After the earliest periods of development are over, there is but a single umbilical vein left, although during the first part of the embryonic existence two are met with, one upon each side of the urachus (and consequently one for each umbilical artery). That on the right side becomes effaced, but its traces may still be found at the thirtieth or even the fortieth day; indeed, some such existed and were perceptible on the embryo I am now describing.

When the umbilical vein has actually passed the liver, it gives off no branches whatever, in its course along the urachus, nor does it divide and subdivide until it reaches the chorion. But, in the earlier periods of gestation, when the two exist, they are observed to spread over the walls of the chest and abdomen in the form of a large vascular plexus, extending as far as the vertebral column; however, this new apparatus soon vanishes and leaves no vestige of its former existence.

The body of the allantoid vesicle disappears very rapidly, and scarcely a trace of it can possibly be found after the lapse of a few days from its first appearance. In fact, nothing more is seen than a cord of variable length, extending from the embryo to the chorion, and having the umbilical vessels inclosed within it. This likewise becomes gradually atrophied in such a way as to disappear altogether in the substance of the umbilical cord; nevertheless, a portion of it still persists in the abdominal cavity of the embryo, forming there the cord subsequently known as the urachus; and just as this latter terminates in the rectum, it exhibits a small swelling which is afterwards converted into the urinary bladder. We may remark, in anticipation, that this rudimentary bladder communicates with the rectum, and constitutes there that transitory cloaca, whose existence in the human species may be positively verined by direct observation. It is this early disappearance of the allantois which has induced some ovologists to doubt its existence in the human race. It is exclusively destined to bring the embryonic vessels into contact with the external membrane of the ovum, whence they are soon placed in their proper relation with the internal surface of the womb.

§ 2. Of the Umbilical Vesicle.

This vesicle is formed exclusively by the internal or mucous layer of the blastoderm; at first, it is very voluminous, occupying nearly the whole cavity of the ovum, and communicating so freely with the intestinal cavity as to form with it apparently but a single vesicle. But the gradual contraction of the ventral opening serves to separate the two, as we have already demonstrated, leaving only a pedicle of variable thickness, according to the size of this aperture.

The umbilical vesicle contains a yellowish-white liquid often of a vitelline yellowness, in which numerous granules and fat globules are seen floating. It seems to be formed of two laminæ, between which the vessels are distributed (see Robin, *Journal de Physiologie*, 1861). As the amnion

becomes developed, the vesicle is crowded by this membrane, and is then found placed between the external face of the latter and the internal surface of the chorion.

In consequence of the development of the allantois, the umbilical vesicle loses much of its importance in the human species, as it so soon becomes an organ of little value either to the growth of the ovum or the embryo: and furthermore, it dwindles away speedily; thus, during the first three weeks, it is as large as an ordinary pea, but after the fourth, it begins to collapse and diminish in size, and at six weeks subsequent to the conception, it does not exceed a coriander-seed in bulk; then it remains stationary for a time, not disappearing altogether until towards the fourth month. I have observed it several times of later years on ova of three to three and a half months, in which it generally still retained the volume and shape of a small lentil, being of a yellowish color, and having its surface wrinkled. However, I may remark, that its size appeared very variable in several ova of the same age.

In proportion as the umbilical vesicle becomes atrophied, it is removed farther and farther from the trunk of the embryo, in consequence of the development of the amnion, and its pedicle is also elongated in a marked manner; thus, the latter is from two to six lines in length, being continuous at one end with the intestine, and at the other with the vesicle by a kind of an infundibuliform expansion. The pedicle is apparently separated into two portions by the amnios, before the abdominal walls are completely closed up; one part lying between the spine, or rather the intestine, and the spot afterwards occupied by the umbilicus, while the other remains exterior to the abdomen. This pedicle is traversed by a small canal for the first five or six weeks of its existence, and through it the fluid in the vesicle may be pressed back into the intestine, but it is obliterated after that period. About the same time, also, it becomes more and more delicate, and often ruptures from its great elongation; and its umbilical portion being lost in the cord, can no longer be traced into the abdomen. When broken, the vesicle may be found more or less removed from the root of the cord, and lying between the chorion and amnion.

The umbilical vesicle has a rich vascular apparatus, the blood of which is carried to and from the embryo by the intervention of two trunks, one venous, the other arterial; both, however, accompany the pedicle, and form a constituent part of it. The first, N (see Fig. 3, Pl. IV.), called the *omphalo-mesenteric vein*, enters the abdomen, winds around the duodenum, and then opens into the umbilical vein at the point *o*, just as the latter is emerging from the liver. As it passes the duodenum, branches are given off to the stomach and intestines, and when it discharges into the umbilical vein, it sends a voluminous trunk to the liver. That portion which furnishes the branches just described, persists in the adult under the name of the *ventral* or *hepatic-portal vein*, whilst all the rest will disappear with the umbilical vesicle and its pedicle.

The arterial trunk P, accompanying the pedicle, has been designated as the *omphalo-mesenteric artery*. Arising from the aorta, it gains the summit of the intestinal convolution, and gives off branches to the mesentery and

to the intestine itself; then it reaches the pedicle, and follows the latter to the umbilical vesicle, upon which it ultimately ramifies. The part that supplies the mesentery is converted in the adult into a mesenteric artery, all the rest being effaced. From all which, it appears that the vascular system of the umbilical vesicle represents the primitive circulation in the embryo, corresponding in it to the sanguiferous apparatus of the yolk of fowls. Of course, these vessels will become atrophied with the organ to which they belong.

The umbilical vesicle seems to be intended to serve as a reservoir for the fluid designed to nourish the fœtus during the first weeks of intra-uterine existence.

§ 3. Of the Amnion.

The most internal membrane of the ovum, or the *amnion*, is formed by the inner lamina of the fold, or the cephalic and caudal hoods which constituted the external serous layer of the blastoderm surrounding the embryo. Being continuous, as we have shown, with the margins of the ventral opening, it seems at first to be attached by its middle part to the skin on the dorsal region.

The internal amniotic surface subsequently exhales a liquid into its cavity, in which the embryo swims freely; hence the amnios constitutes a little sac around the fœtus, having smooth and transparent walls. Its inner surface is bathed by the liquid inclosed in the cavity, whilst its external one is separated from the chorion by a space of variable size, which is likewise filled with a fluid and the expansion of the allantoid vesicle.

Originally, this membrane was not concentric with the chorion; but in proportion as the development advances it presses back the exterior liquid and the allantoid vesicle more and more, thereby condensing it, and finally comes in contact with the external envelope of the ovum. Now, since it adheres to the periphery of the umbilical opening, it must furnish, by such an extension, a sort of membranous sheath to the pedicles of the allantoid and the umbilical vesicles, as well as to their accompanying vessels, surrounding them throughout their course from the umbilicus to the chorion; and all the parts thus inclosed constitute what is called the *umbilical cord;* whence it follows that the abdominal cavity itself must be in connection with the canal represented by this cord, and consequently that the fœtal appendages may communicate with it through the route thus opened to them. It is thus that the pedicle of the umbilical vesicle becomes united to the ileo-cœcal fold of intestine, whilst the allantois connects with the rectum by the intervention of the urachus.

As we have just stated, the amnios is separated from the chorion during the earlier weeks by a filled space, which space is larger in proportion as the ovum is the more recent. This extra-amniotic liquid forms a gelatinous or albuminous mass, of a weblike arrangement, and having the umbilical vesicle in its midst. The mass becomes more and more compact by pressure of the amnion, which has a constant tendency to approach the chorion, thus acquiring the aspect of a membrane (the *membrana media* of Bischoff), which is situated between the chorion and the amnion, where, says this

author, it may be readily distinguished towards the end of pregnancy, as a gelatinous, though continuous membrane. M. Velpeau gave it the name of the *vitriform* or *reticulated* body, but Robin has shown its structure to be identical with that of the allantoid vesicle. Velpeau was, therefore, correct in regarding the reticulated body as the analogue of the allantoid, of which it is really but the remains.

The amnion undergoes no important change during the ulterior development of the ovum, nor does its texture. Of course, it would be more firm and consistent, acquiring by time a greater resemblance to the serous membranes, although it neither incloses nor possesses vessels at any period. Nevertheless, says Dugés, it probably has some openings, which permit the waters, exhaled by the uterine capillaries, and received by the vessels of the decidua and the villi of the chorion, to be diffused around the fœtus; but this perspiration of the liquids secreted by the internal uterine surface, may very possibly be a simple phenomenon of endosmosis.

§ 4. Waters of the Amnion.

The amniotic cavity is filled with a liquid, in which the fœtus is immersed. At the commencement of pregnancy, this fluid is of slight density, and more or less transparent and limpid, but towards term it becomes viscid, unctuous, and more consistent than pure water: sometimes it is as clear as serum; at others, it is of a light yellow or greenish color. It frequently becomes lactescent, turbid, and interspersed with yellowish-gray, or even black albuminous flakes; again, in certain cases, it is strongly tinged with yellow, when the membranes are ruptured, from the admixture of a quantity of meconium; it exhales a disagreeable odor, analogous to that of the spermatic fluid, and its taste is slightly saline.

The quantity of the amniotic fluid varies greatly; thus, in the early months it is, relatively to the fœtus, more abundant, in proportion as the embryo is younger. Riolan found four ounces in an ovum containing a fœtus of the size of an ant. The weight of the fœtus and that of the fluid at the middle of gestation, are very nearly equal. Again, dating from this period, the difference is generally in favor of the fœtus, and the weight of the latter at term is four or five times greater than the waters, which seldom exceed a pound or a pound and a quarter; consequently, if the assertion is true, that the waters augment in their absolute quantity until term, it is equally so to say they increase relatively to the fœtus in the first, and diminish in the second half of pregnancy. In fact, the variations in this respect are infinite, even at the time of the accouchement.

According to the analysis of Vauquelin, 100 parts of amniotic liquor consist: of water 98·8; of albumen, hydrochlorate of soda, phosphate of lime, and lime, 1·2. The interesting question now arises: What is the source of the amniotic fluid? Some assert that it comes from the mother; others, that it is produced by the fœtus. Chaussier, Meckel, and Beclard, adopting an intermediate opinion, suppose that its secretion takes place simultaneously from the female and her product.

Everything proves, says M. Velpeau, that the liquor amnii is the result of a transudation or of a simple exhalation, like the serum of the pleura.

pericardium, &c., and that this process requires no particular canals for its accomplishment, being a phenomenon of pure vital imbibition.

According to Burdach, the amniotic waters cannot be secreted by the fœtus, because they exist prior to its formation,[1] and therefore they must be exclusively furnished by the internal uterine surface, and reach the cavity of the amnios by traversing its walls. We also believe, that the greater part of this liquid comes from the mother's organs; yet we must add that it also contains certain products, secreted by the fœtus: for instance, it is frequently colored by some meconium, and besides, it is almost certain that the urine may be discharged into the amniotic cavity during the latter months of pregnancy. A few incontestable facts prove that such an evacuation is necessary to the maintenance of fœtal life: thus, Billard and T. W. King record having seen cases of ruptured bladder, resulting from imperforation of the urethra; and further, Desormeaux and P. Dubois have observed an obliteration of this canal in two stillborn children, which had given rise to an enormous distention of the bladder, ureters, and both kidneys; indeed, the latter were found transformed into two multilocular cysts. Similar facts have been presented before the Academy of Medicine by MM Depaul and Moreau.

According to some authors, the principal use of these waters is to contribute to the nutrition of the fœtus, during at least a great part of gestation. (See *Nutrition of the Fœtus.*) However this may be, the waters of the amnios serve during pregnancy to maintain the insulation of the external fœtal parts before the skin becomes covered with the sebaceous coat hereafter to be described; to promote the active movements of the fœtus and its development, both of which would have been greatly incommoded without this intervention, by the pressure of the uterine walls; to protect the fœtus from all external violence, and to afford it the means of conforming to the laws of gravity. They likewise favor a uniform expansion of the womb, and remove all pressure from the umbilical cord, thus assuring the integrity of the fœto-placental circulation both during pregnancy and labor. In the latter, they seem destined to guard the child from the violence of the uterine contractions, which, without them, would certainly compromise its existence; to aid in forming the amniotic bag, the engagement of which renders the dilatation of the neck more uniform and easy; to lubricate the pelvic canal, and thus facilitate the descent of the fœtus; and lastly, they render manipulations of every kind less difficult than they otherwise would be.

§ 5. Of the Chorion.

The chorion is the most external envelope of the ovum. Writers are by no means unanimous in their views as to the elements of which it is composed. Thus, some of them, as we have had occasion to state, suppose that it is formed by the vitelline membrane, the external lamina of the blastoderm, and the allantoid vesicle, uniting to constitute a single layer. According to others, on the contrary, the vitelline membrane will disappear soon

[1] It is only necessary to recall our remarks on the development of the amnios to refute this opinion.

after the doubling of the blastodermic vesicle, and the external lamina of the latter, conjoined with the allantois, will then form the chorion.

[M. Robin's view of the subject is as follows: According to M. Coste, three kinds of chorion appear successively, one of which, however, disappears in consequence of the development of its successor which is substituted for it. The *first chorion*, which lasts for a few days only, is formed by the vegetations which cover the vitelline membrane at the time of the entrance of the ovule into the uterus. No vessels have yet appeared, but they carry nutritive matter from the uterus to the vitellus by endosmotic action. The *second chorion* is formed by the external layer of the blastoderm, which is composed of cells resulting from the segmentation of the vitellus. This layer, by gradual pressure against the vitelline membrane, at first lines it, and then causing its absorption becomes itself the external envelope of the ovum or the second chorion. The *third chorion* is formed by the allantoid, which is applied to the internal surface of the preceding chorion, and causing its atrophy by pressure, becomes the external membrane of the ovum which remains until the end of gestation. This membrane is at first covered entirely by vascular villi which, at a later period, remain only at the place where the placenta is developed.

We thus find that these three parts are developed in the order mentioned; but the second chorion is not absorbed; it remains, on the contrary, until the fœtal evolution is completed, lined on its internal surface by the allantoid, the vascular loops of which enter the villi of the second chorion.

Consequently the allantoid never becomes a chorion, meaning thereby the external layer of the ovum, nor is there any other chorion properly so called than the second one formed by the external layer of the blastoderm; inasmuch as the vitelline membrane does not deserve the name, although after the example of Baër and Coste, it has been applied to it by some authors. The vitelline membrane exists, indeed, only before the formation of the embryo, and disappears as soon as the latter and its amniotic membrane become perceptible, leaving exposed the imperforate layer of the blastoderm, which takes the name of chorion. (Robin. *Journal de Physiologie*, 1861.]

But be that as it may, the chorion certainly does not exhibit the same aspect at the advanced stages of pregnancy: for during early embryonic existence the external membrane of the ovum is thin, transparent, and perfectly smooth on its outer surface, whilst about the second week this surface presents some minute granular elevations, which increase in length very rapidly, and the chorion soon becomes studded with numerous villi. But at that time neither the chorion nor the villi have a proper vascular apparatus, since it is not until after the allantois, together with the umbilical vessels, has become applied to the chorion, that vessels can be detected going from this membrane to penetrate the villi.

The chorion is enveloped in a great measure by the reflexed or epichorial decidua, which separates it from the parietal decidua; and is in contact, by a restricted surface, with a portion of the mucous membrane which constitutes the utero-epichorial or inter-utero-placental decidua. There is at the outset a considerable space between its external surface and the internal one of the pouch containing it, which space is occupied by its villi, and may become, as we shall see, the seat of a considerable effusion of blood.

Those villi which are in contact with the reflected decidua, penetrate at first, as they increase in size, into the substance of that membrane; they

soon, however, become atrophied, and dwindle away almost completely, the interval disappears, and the two membranes come into immediate contact.

As regards the villi of the chorion, not covered by the reflected decidua, so far from being atrophied, they speedily undergo a considerable development, when they are in contact with the thickened and softened uterine mucous membrane (utero-placental decidua), and, intercrossing with the numerous vessels developed in its substance, contribute to the formation of that essentially vascular mass we are about to describe under the name of *placenta*.

The chorion is in apposition by its internal face with the amnios at an advanced period of pregnancy; but, as previously noticed, these two membranes are not concentric in the earlier months, being then separated by a considerable space that is occupied by the umbilical vesicle and an albuminous liquid, which is the more abundant and limpid as the gestation is less advanced.

After the development of the placenta, the chorion is a thin, transparent, colorless membrane, united outwardly to the decidua by some short, delicate filaments, the remnants of the atrophied villi, and inwardly to the amnios by an albuminous layer (*tunica media*, reticulated body). The part corresponding to the placenta is no longer in immediate contact with the decidua; it is thicker, and adherent to the fœtal surface of that vascular body, and the attachment is more intimate near the root of the cord. After what has already been stated, it were idle to discuss the vascularity of the chorion, for it evidently has no vessels until after the allantois has been developed; but from that period it consists of two laminæ, the external or primitive of which, also called the *exochorion*, is wholly destitute of vessels, whilst the internal or allantoid is essentially vascular, and has been denominated the *endochorion*.

ARTICLE IV.

OF THE ORGANS OF CONNECTION.

§ 1. THE PLACENTA. (*After-birth, Secundines.*)

The placenta is a soft, spongy mass, constituting the principal connection between the ovum and uterus, being destined to the hematosis, and perhaps also to the nourishment of the fœtus.

It is a flattened body, about three-quarters of an inch in thickness at the centre; but tapering off towards the circumference, which does not often exceed two or three lines; in some cases it is very thin, but then it is very large, and further, its figure and dimensions are exceedingly variable; thus, the ordinary diameter of the placenta varies from six to eight and a half inches, at times one diameter is longer than the others, and the shape, therefore, is circular, oval, &c., according to circumstances. The term battledoor-placenta has been applied to that variety in which the cord is inserted on the border. As a general rule, only one placenta exists in simple pregnancies. However, a very curious exception was observed quite recently at the Clinique of the Berlin Hospital, namely, a double placenta for a single child. Dr. Ebert furnishes the following description of this anomaly:

When displayed on a table, it was found to be divided into two exactly equal rounded parts, which were entirely distinct, having no connection whatever with each other, excepting through the intervention of the cord and membranes; an interval of about three inches separated the two portions. The cord was twenty-one inches long, containing, as in the normal state, the three vessels spirally arranged, but this spiral form ceased nearly two inches from the bifurcation of the umbilical vein, at this point the two arteries were placed, one on each side of the vein, and only communicated by a trifling anastomosis.

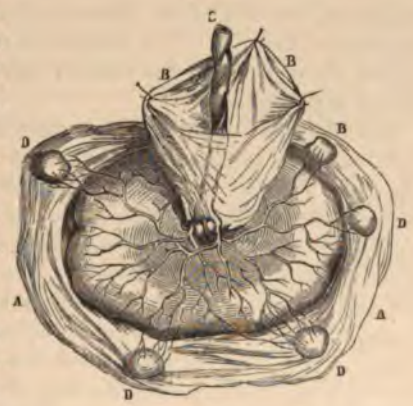
The vein bifurcated about four inches from the placenta; the two resulting branches were of unequal length, and the longest sent a branch to the opposite placenta. The arteries had a similar arrangement, one being sent to each after-birth. The one corresponding with the longest vein likewise sent a branch to the other placenta, but the interior subdivisions of the vessels offered no further anomaly.

The membranes formed a single cavity for the fœtus and amniotic waters; they invested the two portions of the cord, the fœtal face of both placentas, and passed from one organ to the other, thus establishing a kind of membranous bridge between them, which, with the cord, was the sole point of communication between these two masses. (*Arch. Gén.*, 1842, t. xiv.)

A similar case has recently occurred at the *Clinique d'Accouchement de Paris*, a drawing of which has been prepared by M. P. Dubois.

A placenta presenting the same anomaly, was recently exhibited by me to the Biological Society. This specimen derived additional interest from the fact, that it was the product of a double pregnancy, the other ovum having a distinct and regularly formed placenta.

Fig. 64.



Placenta, with five separate Cotyledons.
A. Chorion. B. Amnion. C. The Cord. D. Separate cotyledons.

A much more singular case has been obligingly communicated to me by Dr. Blot. In this instance, the placental mass presented nearly the usual appearance, but around it were distributed several entirely distinct cotyledons, which were connected with it only by the vessels proceeding from them to join the ramifications of the cord. (Fig. 64.)

The after-birth presents a *fœtal*, or *internal*, and an *external*, or *uterine* surface; also a circumference, or border. The internal surface is covered both by the chorion and amnion, and exhibits numerous ramifications of the umbilical arteries and vein, which generally converge about the centre of this body to form the umbilical cord. The uterine surface is much less smooth, polished, and uniform than the preceding, and is slightly convex, whilst the former is a little concave. It is subdivided into a variable num-

ber of lobes, or irregularly rounded cotyledons, held together by a lamel lated, apparently albuminous tissue, which is so easily lacerated, that a rup ture may occur during the separation of the placenta, so that after its

FIG. 65.

FIG. 66.

FIG. 65. The internal, or fœtal surface of the placenta.
FIG. 66. The external, or uterine surface of the placenta.

expulsion, the cotyledons appear to be separated from each other by deep furrows or fissures. This surface is covered by a thin layer of adhesive matter through which the reddish and sanguinolent appearance of the coty ledons is perceptible.

The placental circumference is thin and irregular, and its extent, although very variable, is generally about twenty-five inches. The margin, accord ing to M. Velpeau, is continuous, without a well-marked line of demarcation, with the double lamina formed by the folding of the deciduous membrane. But in the opinion of other anatomists, the periphery of this vascular mass is continuous with the chorion, and only *contiguous* to the double fold of the decidua, which is there thicker and more dense, and presents a kind of triangular sinus for the reception of the placental border.

Our future remarks upon the structure of the placenta will serve to show that its circumference is continuous with both the chorion and the decidua; with the chorion by its fœtal portion, which, after all, is formed by the hypertrophied villi of the chorion; and with the decidua or parietal mucous membrane by its maternal portion, which is but a thickened part of this same uterine mucous membrane.

[*Structure.* — That we may not be misled whilst studying the structure of the placenta, I think it best to state briefly the manner in which it is formed.

The history of its development shows that it formed of the villi of the chorion, the growth and ramification of which give rise to innumerable filaments which ingraft themselves upon the intermediate mucous membrane to which they soon adhere closely. The maternal vessels undergoing an inverse development form vast numbers of loops, which descend between the villi of the chorion and extend to the fœtal surface of the placenta. An amorphous matter is soon deposited between the villi of the chorion uniting them together, and the placenta thus formed is at the same time a maternal and fœtal organ.

The separation of the placenta after delivery takes place at the most superficial portion of the intermediate mucous membrane. (See *Inter-utero-placental Decidua.*

The fœtal placenta comes entirely away, bringing with it the epithelial layer of the inter-utero-placental decidua and the placental distribution of the maternal vessels. The thickest part of the intermediate mucous membrane remains, on the contrary, attached to the uterus. (See *Decidua*, and *Lying-in state.*)

Such, in short, are the principal phenomena which occur during the development and separation of the placenta, and they will serve to guide us amidst the different opinions which have been advanced respecting the structure of the organ.]

The structure of the after-birth has been a theme of numerous discussions among embryologists; but the researches of MM. Blandin, Jacquemier, Flourens, and Bonami, in our own times, and even yet more recently those of Reid, Weber, Coste, Eschricht, and Robin, have thrown much light on this subject.

We have sought laboriously for the truth amongst these different opinions; and in believing that we have found it in the facts established by M. Robin, we are no less convinced that the task has been greatly facilitated by the researches of his predecessors. In order to render justice to all, we consider it our duty to give an analysis of the principal investigations which have been made in reference to this interesting point of ovology.

If, while the placenta is still adherent to the uterine wall, a careful effort be made to detach it, we can easily see that this detachment takes place at the expense of a particular tissue, which at once separates and holds the two surfaces in contact. Now, this utero-placental substance is of an albuminous or membranous nature, and is composed, according to Robin, of the epithelium of the intermediate decidua. This membranous layer (that has also been accurately described by M. Jacquemier) is moulded, as it were, on the irregular surface of the placenta, to which the adhesion is more perfect than to the corresponding part of the womb; it dips into the fissures that separate the cotyledons, unless these should happen to be very deep, in which case it merely passes from one lobe to another, thereby forming a species of membranous bridge; but a partition of the same nature much thicker than the preceding penetrates deeply between the lobes. The lamina clothing the external surface of the placenta is continuous with the decidua, without exhibiting any other difference, says the same author, than a considerable augmentation of thickness; a disposition that is apparently mechanical, being due to the relief made by the projecting circumference of the after-birth, and which thus determines around that organ a greater accumulation of plastic material. According to that able anatomist, this membrane offers all the physical characters of the decidua; and he seems quite disposed to consider them both as being one and the same.

This inter-utero-placental tissue is traversed by a great number of venous and arterial vessels, which pass from the internal surface of the uterus to the placenta (utero-placental vessels); but it does not appear to be the ultimate termination of a single blood-vessel. No trace of the injection remained, in this tissue, in the preparations just alluded to, made by M. Bonami.

Let us proceed, however, to the vascular structure of the placenta, properly so called; and, as I have witnessed the injections of M. Bonami, I cannot do better than transcribe here the following parts of his thesis:

"An injection, composed of spirit-varnish, colored with red-lead, was first thrown into the venous system of the uterus through the primitive iliac and one of the ovarian veins. A second, consisting of spirits of turpentine and indigo, was then made of the uterine arteries through the inferior extremity of the aorta, ligatures being previously placed on all the vessels capable of transmitting the injected fluids to the inferior extremities.

"The uterine cavity having been opened at some distance from the placental insertion, and the fœtus stripped of its membranes, a blackish liquid, which was nothing but the blood, was next squeezed from the vessels of the cord; then injections, having linseed-oil colored with white-lead and yellow ochre as their base, were thrown into the umbilical vein, and into one of the arteries."

These injections were made with the greatest possible precaution, and the following results were afterwards obtained from a careful dissection: "At first, the red liquid injected into the uterine veins could be distinctly perceived on the fœtal surface of the placenta. But, by what canals could the injection have penetrated so far as this? Here was a new subject of research; but, by carefully turning the placenta aside, a considerable number of small vessels could easily be recognized, leaving the internal surface of the womb, traversing the inter-utero-placental tissue just described, and plunging into the substance of the placenta. These consisted of arteries and veins, readily cognizable as such by the different colored injections."

1st. *Arteries.*—The number of these is large, and they are more abundant near the centre of insertion than anywhere else; still, a few very delicate ones are found about an inch from the placental circumference. Generally, they are quite small, varying from a fourth of a line to a line in diameter. They assume very sensibly a spiral arrangement, and their course is oblique, almost always creeping along for a third of an inch, sometimes more, before their terminal extremities are directed towards the anfractuosities of the placenta; and they evidently penetrate the proper substance of the latter, though towards the uterus they are clearly continuous with the uterine arteries. Lastly, they have but few ramifications, and these rarely anastomose with each other.

2d. The *veins* pass from the uterus, through the inter-utero-placental membrane, towards the placenta, but they have not the same disposition as the arteries.

The calibre of these veins, says M. Bonami, is nearly equal to that of the arteries, sometimes even a little larger, some of them being from two to three lines in diameter. The characters by which we could distinguish these from the arteries, were conclusive in the piece under examination. Thus, these veins were penetrated by liquids thrown into the uterine venous system; they were rectilinear, and their exceedingly numerous ramifications anastomosed freely with each other, thereby forming vast plexuses on the cell-walls, which penetrated the uterine surface of the placenta at all points; and, on the other hand, by further dissection, could be seen with the naked eye terminating in the large uterine veins. Besides these, according to Meckel and Jacquemier, there exists a vein which encircles the periphery of the placenta; but this coronary vein is rarely complete, as it nearly

always exhibits one or more interruptions of an inch or two in extent, although its continuity is sustained by a series of veins anastomosing with one another, and its course exhibits numerous varicose-like dilatations. It communicates, at short distances, with the uterine veins, and receives contributions both internally and externally; some of these spread over the uterine surface of the placenta, and anastomose with the veins that penetrate this body at its centre; the others, which are less numerous, ramify in the substance of the decidua, two or three inches from the circumference of the placenta. M. Robin says that it resembles a uterine sinus, and is more properly one of the latter excavated in the mucous membrane than a true vein. The presence of this coronary vein is not constant, for neither Velpeau nor Bonami have ever met with it.

There are, therefore, certain arteries and veins that penetrate the placenta, belonging to the maternal vascular system; but before studying their distribution, let us examine that of the umbilical vessels. These, consisting of the umbilical arteries and vein, having arrived at the fœtal surface of the placenta, divide into several large branches that are found between the amnion and chorion. The first of these membranes may be detached with great facility; but the second intimately adheres to the vessels, which it completely envelops, thus forming a sheath in which one artery and one vein are always found, the vein being much the larger; shortly after, each trunk divides into two branches, each of these into two others, and thus they go on subdividing dichotomously almost *ad infinitum*. The two umbilical arteries communicate freely with each other in the substance of the same cotyledon, and this anastomosis may even be seen without the aid of an injection. Again, if a coarse injection be thrown into one of the arteries, it will shortly return by the other; though, if the pressure be continued, it will pass from the arteries into the umbilical vein; but if we commence by filling the vein, the injection reaches the arteries with more difficulty. If a very penetrating mixture be used, the whole uterine surface of the placenta will be converted into a very delicate plexus, which never affords an outlet to the injected liquid; *patulous orifices do not exist, therefore, at the extremities of the vessels.*

When a placenta has been thus injected, and is then macerated, it soon appears to resolve itself into a substance resembling woolly flakes covered by numerous particles of a soft pulpy tissue, that is detached from them with much difficulty. These flakes present under the microscope a large number of granulations, composed of small, convoluted, twisted vessels, like those in the chorial villi of the cow or the sheep. These small granules have been described as *acini*, or little grains. The vessels become longer as the maceration is continued, and finally lose flexuosity almost entirely.

On the whole, therefore, the placenta is formed by vessels belonging to the mother as well as by those appertaining to the child, and each of its cotyledons is constituted in the following manner: the maternal, or utero-placental vessels penetrate at all points of its uterine surface, forming in its substance a net-work of exceedingly delicate meshes, while the umbilical vessels that penetrate on the fœtal surface present those infinite ramifications just described, and these twist around and embrace the contracted

meshes of the maternal plexus in all directions. Further, the connection existing between these two orders of vessels appears to result from the membranous sheath that envelops them both, even into the substance of the placenta.

This sheath is furnished to one set by the chorion, to the other by the extremely delicate prolongations of the maternal vessels. In other words, being compressed and united with each other through the intervention of a common substance, these divisions and subdivisions form a cotyledon of the placenta.

Again, all the minute vascular ramuscles are so intimately connected that it is impossible to separate the vessels belonging to the mother from those peculiar to the fœtus, and they can only be distinguished from each other by the different colored injections. But, although the two series thus interlace, the maternal branches never communicate by their terminal extremities with those of the fœtus; since the finest injections, when most carefully made, have never established a direct communication between these two orders of vessels,—unless by rupture of the walls.

The description of Eschricht is very analogous to that of M. Bonami; thus, the former concludes that two orders of capillary plexuses are in contact in the human placenta, and that the uterine arteries are continuous with the veins of the same name through a capillary plexus, equally delicate with the one existing between the umbilical arteries and veins.

But the researches of Weber have led to different conclusions as to the mode in which the uterine arteries run into the veins of a similar name in the placenta, and these curious results deserve some notice, inasmuch as they seem to form a natural transition to the arrangement which we shall describe hereafter.

He states that the uterine arteries enter the after-birth without giving off any arborescent ramifications; and, on the other hand, that the veins do not arise by delicate ramuscles, but present, at their very origin, large trunks, which by anastomosing with each other very frequently and at all points, seem to form in this manner a system of cells, whence the blood then passes by some venous trunks into the uterine veins. These latter are continuous with the arterial tubes from their origin; their walls are excessively thin in the placenta, being there reduced to the internal coat, and collapse, so as to be nearly invisible when they contain but little blood. The terminal ramifications of the umbilical vessels project into these venous sinuses; moreover, the thin tunic of the vein is pushed into the interior of the vessel by the fœtal villus resting against its outer surface, and it thus furnishes a sheath to the latter, which seems to penetrate to the interior even of the maternal vascular tube, though in reality it does not.

Read, in August, 1840, easily verified, he says, the existence of the utero-placental vessels, when examining the uterus of a pregnant woman, who died at the seventh month.

After having detached a portion of the placenta under water, my attention was drawn to a number of rounded bands passing between the uterus and the external surface of the placenta. When the least traction was made, their walls became thinner as their length increased, and had a cel-

lular appearance, though they were easily lacerated; whilst sometimes, though more rarely, they seem to separate like the tufts of the uterine sinuses. By cutting into one of the sinuses, these tufts could be traced, and seen to ramify in its interior; some seemed to penetrate the patulous opening of the sinus only, while others sank in for about an inch, and appeared to penetrate even the surrounding sinuses. I could easily satisfy myself by injection and microscopical inspection, that these tufts were the ultimate ramifications of the umbilical vessels.

It is scarcely necessary to add, that these tufts only penetrate the openings of the sinuses situated near the internal surface of the uterus, and not those more deeply seated. Their volume varies very much, some appearing to fill the opening of the sinus entirely, whilst others only occupy it in part. Again, although the tufts appeared loose, and floating in the interior of the maternal vascular tube, yet they were evidently surrounded by the internal tunic of the latter, which was reflected on their external surface.

I have assured myself that some of the utero-placental veins contained no prolongation of the fœtal vessels, but in many others the villous tufts (the terminations of the umbilical vessels) could be recognized and followed into the uterine sinuses.

In tracing these utero-placental veins that contain no fœtal vessels through the decidua to the surface of the placenta, the internal membrane of such veins is found prolonged on the neighboring placental tufts; and further, by following a large utero-placental artery through the decidua, we may see that as soon as it arrives on the face of the placenta, its internal tunic is prolonged on certain tufts that are found plunged in its orifice.

The numerous branches of the fœtal tufts which stop at the placental surface of the decidua, and neither penetrate into the uterine sinuses, nor yet into the orifices of the utero-placental vessels, are fixed by their extremities to the placental surface of this membrane. Consequently, the placenta is formed interiorly by numerous trunks and branches (each containing an artery and a vein), and each of these branches, both venous and arterial, is surrounded by a prolongation of the internal tunic belonging to the maternal vascular system, or at least by a membrane continuous with that tunic. Hence, in adopting such ideas of the placental structure, it becomes evident that the internal tunic of the mother's vessels is prolonged on each placental tuft, in such a manner that the maternal blood, arriving by the utero-placental arteries, passes into a large sac formed from the internal lamina of these vessels, and the blood is thus divided into a thousand different directions by the placental villi, which project like fringes into these vessels, pressing in their thin, soft parietes before them, and forming sheaths therefrom which completely envelop each trunk and each branch. The blood returns from this sac by the utero-placental veins without any extravasation or abandonment of the vascular system to which it properly belongs. Therefore, the fœtal blood, and that of the mother, can have no action upon each other, excepting through the spongy parietes of the fœtal vessels and the thin sac that surrounds them.

It will be seen that but a single step has now to be taken in order to reach the description given by M. Coste.

It is really impossible to obtain a correct idea of the structure and development of the placenta, without being acquainted with the nature and structure of the villi of the chorion, as also with the changes undergone by that portion of the uterine mucous membrane (utero-epichorial decidua) upon which the ovule is ingrafted.

A. *Villi of the Chorion.* — We have already stated that before the allantoid is developed, each villus of the chorion contains a canal, which is open at its base, but terminates in a cul-de-sac at its free extremity; after the allantoid is developed, the terminal ramifications of the umbilical vessels, both arteries and veins, penetrate into this canal as into the finger of a glove. The villi, after having been thus rendered vascular, become atrophied, and

Fig. 67.

This figure represents the manner in which the villi of the chorion ramify. — c c. Trunk of the villus. E. Terminal ramification intact. G. A terminal branch broken off. V. A lateral branch.

finally disappear from all that part of the chorion which is covered by the reflected or epichorial decidua. Those, on the contrary, which are in immediate contact with the utero-epichorial mucous membrane (inter-utero-placental decidua of authors), undergo a considerable development, and ramify *ad infinitum*. When viewed collectively at this period, they have the appearance of a soft, hairy mass, very tufted and flaky, and of a semi-transparent gray rose-color.

If the villi which compose this hair-like mass of the chorion be separated from each other and examined, the following characters will be found applicable to all: a common pedicle, forming the base or trunk of the villus, about one-sixteenth of an inch long, and one-half as wide, for an ovum of six weeks, the dimensions varying, however, with the size of the ovum. From this pedicle are put forth numerous branches, forming a bulky tuft. The largest of these branches, after dividing two or three times, are again subdivided into innumerable minute branchlets.

Again, some of the smaller branches stand alone upon the surface of the chorion, in the interspaces of the tufted pedicles just mentioned.

The extremities of the subdivisions of the third and fourth orders are here and there found to present a sort of cylindric or flattened swelling.

One of the principal subdivisions of the umbilical arteries and veins is distributed to each of these pedicles, and extends into all of its branches, ramifying as it goes.

Inasmuch as the branches of any one pedicle have no communication with those of a neighboring one, it follows that each tuft of the chorion has a circulation of its own.

Although the terminal villi become longer, their thickness is not sensibly increased, for their diameter is nearly the same after, as before the development of the placenta.

B. *Utero-epichorial Mucous Membrane.*—These hypertrophied villi come in contact with a very thick and much softened portion of the uterine mucous membrane. As they grow longer, they penetrate into the tissue of the mucous membrane itself, excavating therein a species of cells or lacunæ, which can be seen without difficulty upon the bottom of the receptacle represented in Plate III., Fig. 53.

Since the arteries, but more especially the veins, are so developed at this point that the frequent dilatations of the latter form large cavities or sinuses, from one-eighth to one-quarter of an inch in diameter, the vascular villi of the chorion necessarily come in contact with the walls of the uterine vessels. According to M. Coste, the latter are even worn through by the villi of the chorion, which having thus gained entrance into their cavities, are suspended freely in the blood which fills them.

Soon these infinitely numerous and elongated villi become united to each other by means of an amorphous substance, which is deposited in small quantity amongst them, so as to give to each tuft of the same pedicle the compactness which each placental cotyledon presents at a more advanced period of pregnancy.

The villi taken from the placenta immediately after labor, differ from those described only in the greater number of their ramifications, and the larger size of the pedicles and of the principal branches which they put forth.

The fœtal portion of the placental tissue is formed, in short, of interlaced filaments, which are simply the chief branches of the villi of the chorion, whose ramifications can be followed to their termination only by the use of a lens, so inextricably entangled are they, and agglutinated by the amorphous matter of which we have spoken. They thus form, by their agglomeration, a tissue of a reddish-gray color, soft, elastic, giving way to pressure of the finger, and yielding a filamentous fragment by tearing.

The structure of all the villi is not, however, identical at the termination of pregnancy. Although the greater number preserve until the end the double vascular canal which they presented at the beginning, the vessels of a few become atrophied, and like the non-placental villi, finally constitute a very slender filament devoid of a canal. Fig. 68, for which I am indebted to the kindness of M. Robin, exhibits these differences, besides showing

very clearly the admirable disposition of the fœtal vessel within the villus itself.[1]

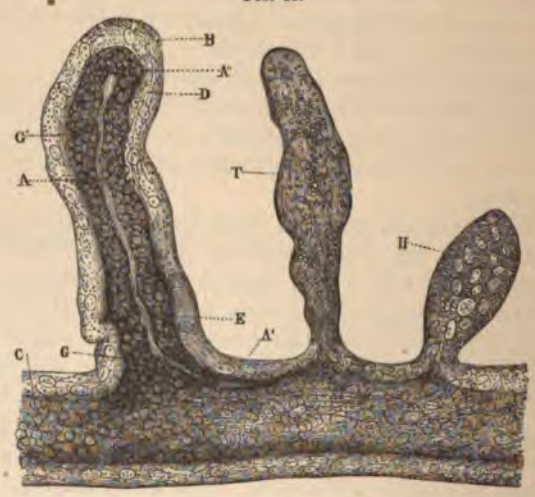
Thus H and T represent a terminal prolongation of the branches of a placental villus, ovoid in shape, with a contracted pedicle and obliterated cavity; at B is another terminal prolongation of the same villus, having the structure which almost all of them retain in the placenta. It is composed of an external envelope B, or wall of the villus, of a structure identical with that of the chorion. Its thickness, and consequently that of the substance separating the blood of the fœtus from that of the mother, may be estimated approximatively. It is about ·0004 of an inch.

This villus presents internally a partition, A, dividing its cavity into two vascular tubes. The tubes are situated beside each other, like the barrels of a double-barrelled gun; they bend toward each other at A″, so as to form a single canal at the extremity of the villus, which is arterial at D E, but venous at G′ G. This partition A has only half the thickness of the external wall B. It has a spur-like termination at A″, and adheres by its base at A′ to the wall of the villus.

When this disposition of the terminal ramifications is once understood, all discussion, as M. Robin remarks, respecting a direct communication between the maternal and fœtal vascular systems, is ended.

Each of the capillary vessels of this double canal empties into a corresponding one of larger size, at the point of junction or of separation of a ramification with a larger branch; for example (Fig. 68), the arterial tube

FIG. 68.



The figure represents a fragment of the villi of the chorion obtained from the placenta. It exhibits prolongations of various appearance. Magnified 360 diameters.

D E empties at A′ into the trunk of the same nature of the principal branch C V, and the venous tube G′ G discharges at the point C.

[1] The minute details into which I am about to enter, are the analysis of the researches of my learned colleague and friend, M. Robin. They are for the most part recorded in an excellent memoir published by him, and also in the thesis of M. Cayla, one of his pupils.

The placenta is therefore composed of two parts, which are very distinct, in a physiological point of view, although they are confounded in a single mass at the end of gestation. One of these is the fœtal portion, and is more especially adherent to the chorion, from which it takes its origin; the other the maternal portion, is a greatly thickened part of the uterine mucous membrane.

It is very difficult to say what is the real mode of connection between these two elements of the placenta, since such different results have followed the dissections of the most skilful anatomists.

Their continuity, or direct communication, is at present, however, out of the question, for all are united in regarding their relation as one of simple contact, a greater or less extent of adhesion.

[The foregoing represents what was known until within a few years past, of the structure of the placenta. More recently, Professor Robin, who at first accepted the ideas of M. Coste, has changed his opinion on the subject, and we have now to state his present views. (Various memoirs and oral communications.)

A close examination of the external surface of the placenta, will soon show that the entire surface of the cotyledons is covered by a grayish, semi-transparent, and soft membrane, from the $\frac{1}{50}$ to the $\frac{1}{70}$ of an inch in thickness in different specimens. This membrane, whose existence we have already asserted, is sometimes smooth, sometimes rough, quite elastic and adhesive, and of a peculiar appearance. It passes without interruption from one cotyledon to another, being only rather thicker in the interstices. It is formed by the epithelium of the inter-utero-placental mucous membrane in its thickened and hypertrophied condition. A few other elements, derived from the most superficial portion of the same mucous membrane, are also found in it, such as laminated fibres, amorphous matter, and molecular granules of various kinds.

This layer represents the maternal placenta, and is traversed by a profusion of maternal capillary vessels which pass into the body of the placenta. If these vessels be followed into the soft, grayish, and glutinous layer, just described, we find that they become gradually flatter and more irregular; they are distributed over the convex surface of the cotyledons and in their interstices, and at all these points enter deeply in an oblique direction toward the fœtal surface of the placenta. In pursuing this course, their walls become so extremely thin that they are often discerned with great difficulty. (Robin. *Communications orales.*)

Having entered the placental tissue, they dilate and communicate so largely as to form throughout the entire mass of the placenta a pool of blood, which bathes the entire placental surface of the chorion at the point of attachment of the pedicle of each villus.

This expanse of blood penetrates the fine sponge-like interstices between the reticulated ramifications of the villi, but nowhere is there any direct communication between the maternal and fœtal blood.

Beneath the preceding layer is found the fœtal placenta, which constitutes the greater bulk of the organ and is formed by the expansion of the villi of the chorion agglutinated by amorphous matter. Amongst these villi are distributed the numerous maternal vessels.

The glutinous layer, formed by the epithelium of the serotina at the surface of the placenta, is always present, unless accidentally removed: thus proving the very important fact that the placental villi are not plunged freely by means of floating extremities in the sinuses of the serotina. The cotyledons, it is true, project toward the utero-placental mucous membrane which, in its turn, penetrates somewhat into the furrows which separate the cotyledons: still, their convex surfaces are merely

applied against the sinuses of the serotina, which glide between the villi in order to open into the above-mentioned pool of blood resulting from the enormous dilatation and the destruction here and there of the walls of the capillaries of the superficial net-work of this part of the mucous membrane.

The adhesion between the cotyledons and the mucous membrane is molecular and so intimate, that, instead of merely separating from the latter, it brings away with it the superficial layer of the serotina.

Notwithstanding this, it is true that, in an anatomical point of view, the cotyledons, in fact the placenta, are merely applied by the surface, against the intermediate mucous membrane. The fœtal villi are not plunged in the form of arborescent or radical branches in the tissue of the serotina, as all the descriptions would seem to indicate, but it were more correct to regard the maternal blood as seeking them at a certain depth in the mass of the cotyledons.]

The placenta appears to be destitute of nerves and lymphatic vessels.

All the cotyledons composing the placental mass are, as we have said, united by the interlobular membrane. Occasionally, however, one or several of these lobes are separated from the others, and seem to form another placenta by their isolation; in this way it has happened that several placentas have been attributed to a single fœtus, and, perhaps, the facts mentioned at the beginning of this article are to be accounted for in the same way.

The placenta may be inserted upon any part of the uterine cavity, and even upon its orifice, though most usually it is fixed near the fundus of the organ. It has been customary to account for these varieties of insertion, by saying that the latter is determined by the most vascular portion of the organ; overlooking the fact, that, although the point of attachment be indeed more vascular than any other part of the uterine parietes, it is simply because of the insertion, thus confounding the cause with the effect. According to some authors, the weight of the ovule determines the point of insertion of the placenta, which, if true, should most frequently take place upon the neck. Observation, however, refutes this opinion. Finally, according to MM. Moreau and Velpeau, when the ovule enters the womb, it is obliged to separate the decidua from the wall of the uterus, and therefore naturally tends towards the points of least resistance.

The details which we have given respecting the mode of formation of the decidua, show that the latter opinion is without foundation. The following seems to us to be the most probable explanation: Generally, by the time the ovule enters the uterine cavity, the latter is filled to repletion by the folded and swollen mucous membrane. This state of things renders it almost impossible that it should progress very far, and the consequence is, that in the vast majority of cases it lodges in one of the numerous folds near the fundus, and becomes attached in the vicinity of the orifice of the tube by which it entered. The placenta is, in fact, generally found in this neighborhood. Why, in some cases, it should be situated in the inferior segment of the womb, is of more difficult explanation, except upon the supposition that fecundation was effected after the arrival of the ovule in the uterine cavity; in which case, in consequence of the less swollen condition of the mucous membrane, it may have been able to obey the laws of gravity immediately upon entering the cavity, and thus descend towards the lowest points.

Sometimes the insertion of the placenta upon the lower segment of the uterus occurs in several successive pregnancies. Ingleby relates one case in which it happened three times, and says he knew the same thing to occur ten times in another. M. Dunal, from whom I quote the above, gives an observation of M. Ménard, in which the woman had this unfavorable insertion twice consecutively. Whether this sort of habit can depend upon a peculiar disposition of the Fallopian tube or of the uterus, is a question which anatomical research only is competent to decide.

§ 2. THE UMBILICAL CORD.

The umbilical cord is the flexible trunk, which unites the abdomen of the child to the placenta; it does not exist during the early weeks of pregnancy, and its formation only commences when the embryo is completely separated from the blastodermic vesicle, which thereby becomes the umbilical vesicle; when the allantois, by being confounded with the external lamina of the blastoderm, no longer constitutes a distinct vesicle, but is merely a simple cord upon which the two umbilical arteries and the vein ramify; and when all these parts have received an enveloping sheath from the amnios. Now it scarcely appears thus formed until towards the end of the first month, being composed at this period, in all *normal embryos* of the age of the one which we shall describe (page 210), of three distinct parts: 1, of an enveloping canal, whose walls are formed by a reflection of the amnios, and which is continuous at the umbilicus with the skin of the embryo; 2, of two pedicles proceeding from the fœtal appendages, around which this amniotic canal forms a sheath, and which communicate, the one under the name of the *pedicle of the umbilical vesicle*, with the ileo-cœcal fold of intestine, and the other, under the name of *urachus*, or the *pedicle of the allantois*, with the bladder.

But soon after, as the development progresses, and the pedicle of the umbilical vesicle is absorbed, the cord becomes simplified, and is reduced to the amniotic sheath and the urachus, accompanied by the umbilical vessels, with which this sheath is confounded by the obliteration of the canal that constitutes it. The effacement of this canal, along which only the urachus and its accompanying vessels pass, progresses from the chorial extremity of the cord towards the umbilicus, or abdomen of the embryo; and, as the progressive obliteration approaches the latter, it encounters the intestine which advances beyond the umbilicus, and forms a hernia in the cord itself; but this rupture is naturally reduced, in consequence of the pressure exercised on the bowel by the progress of effacement, which ultimately reaches the navel, and presses back into the abdomen everything met with outside of its cavity. However, in some instances this process is not completed in so efficacious a manner, and the intestine in such cases remaining beyond the umbilicus, produces the malformation known as *congenital hernia;* a hernia that is nothing more than the persistence of an anatomical disposition, which always exists temporarily at a certain period of the embryonic life.

The cord, at the end of the first month, is still thin, cylindrical, and very small; but from the fourth to the eighth, and even the ninth week, it

acquires a considerable proportional volume; and it exhibits either some enlargements, vesicles, or swellings, two, three, or four in number, which are separated from each other by a corresponding number of bands, or contractions.

During the third month it diminishes in size, in consequence of a retraction of these tuberosities; but again, commencing from this latter period, it continues to grow proportionally to the other parts of the fœtus until the end of gestation.

The cord varies greatly in length at term: generally, it is from twenty-one to twenty-three inches; some have been observed, however, from six inches to five feet (one metre fifty-three centimetres); others, still more rare, have reached five feet nine inches in length (one metre seventy-five centimetres). I delivered a woman with the forceps, June 23, 1841, in whom the head had been retained above the superior strait, and where the cord was only nine inches long. These extremes are very rare; nevertheless, they are not the utmost varieties the cord may offer in its extreme limits, for it has been known not to exceed five inches, and has even been as short as two inches.

In a case reported by Mende, it was so short that the placenta absolutely seemed fixed to the child's abdomen. Its size likewise varies in different subjects, being generally about that of the little finger, sometimes much smaller, and at others very large; but in all these cases its volume depends much less on that of the vessels than on the quantity of fluids accumulated in the surrounding tissue.

The nerves and lymphatic vessels, which certain authors have described as belonging to the cord, are still a subject of research; admitted by some and denied by others, their existence is at least problematical.

The arteries are two in number, and, following the course of the blood, they arise from the bifurcation of the abdominal aorta in the fœtus, and reach the umbilicus, whence they traverse the entire length of the cord, describing numerous flexuosities as far as the placenta, in the tissue of which we have already followed their ramifications.

The vein, still following the route of the blood, arises from the numerous ramuscules studied in the placenta; the venous radicles of each lobe unite to form branches, which in their turn aggregate on the fœtal surface of the after-birth, to form there the trunk of the umbilical vein; and the latter, having arrived at the umbilical ring, abandons the two arteries, and runs towards the liver. (See *Circulation of the fœtus.*) The vein is nearly equal in size to the two arteries united; but it is much less flexuous, and consequently its course is shorter.

These vessels are wound upon each other in a way nearly similar to the twigs of osier forming the handle of a basket; they give off no branches in the cord, and it has been remarked that the twisting of the vessels, which only begins after the second month, takes place, nine times in ten, from left to right. The vein usually occupies the axis of the cord, and the arteries wind uniformly around it. Of course, this enrolling must depend somewhat on the torsions of the embryo itself, and then the entire cord, together with its sheath, is involved, as not unfrequently happens; but when the cord is

straight, and the arteries are twisted at least more than it is, these contortions seem to result from a more rapid growth of the vessels within the sheath, than of the sheath itself (Haller). Now, the embryo and placenta being immovable, the turns starting from these two points will necessarily meet each other, and this indeed frequently takes place. Two, and even three umbilical veins have been met with in some cases; in others, instead of two arteries there is but one. Osiander once found three of the latter. It is worthy of remark, that neither the arteries nor the veins have valves at any part of their course.

These vessels are surrounded by a gelatinous substance called *Wharton's gelatine*, which is variable in its quantity, thereby giving rise to the division made by accoucheurs into the thin and fat cords. This substance is continuous on one part with the sub-peritoneal cellular tissue of the fœtus, and, on the other, accompanies the vessels into the placenta. Being spongy in character, it is constituted by a clear, tenacious liquid, contained in the cellular areolæ, that communicate so freely with each other. The cord frequently has one or more knots when it is very long, some of which are formed during pregnancy, and often even at an early stage; but others are only produced at the period of labor: they never become so tightened (in gestation) as to compromise the life of the child, to whose movements they are certainly due; but we can understand that the cord may become tightly drawn during labor, from being shortened by circular turns around the trunk or neck; the knots, in such cases, may be so hardened as to intercept the circulation completely, and the death of the fœtus will necessarily result if the labor be prolonged. In one case, figured in the work of M. Baudelocque, the cord was knotted three times at the same place, and was interlaced like a mat.[1]

M. Soete, an accoucheur at Gheluwe, has described a very singular case of double pregnancy, in which the two fœtuses were inclosed in the same bag, and the two cords formed a perfect knot with each other.

Fig. 69.

An anomaly, described by Benckiser.

Besides these knots, true nodosities likewise exist at times in the cord, produced either by the duplicature or the varicose state of one of its vessels.

We have already stated that the cord is attached by one extremity to the umbilicus of the child, and by the other to some point of the fœtal surface of the placenta; but this, however, is not always the case, for the facts are too numerous which go to prove that the cord may indeed be inserted on the head, neck, shoulders, and other parts of the

[1] The ancients thought they could determine the fecundity of the female by these knots: thus, according to Avicenna, the more knots the more will be the future conceptions; and if they occur at some distance apart, the pregnancies will also be more distant from each other. — (*Israelis Spachii gynæceorum libri.*)

fœtal trunk, not to admit some of them, at least; such, for example, as the one observed by M. Jules Cloquet, at Brussels. The placental extremity of the cord also presents some anomalies; it is usually fixed very near the centre, but sometimes is found attached to a part of the periphery, bearing then the title of *the battledoor-placenta*. Nor is it always attached to a point of the fœtal surface of the placenta. For instance, Benckiser has collected in his thesis numerous cases in which the cord was inserted at some point on the periphery of the membranes; and having arrived there, the vessels of the cord then divide into five or six large trunks, the branches of which, by ramifying between the membranes, reach the placental circumference, and plunge into the parenchyma of this body. (See Fig. 69.)

All such modifications, however, merely depend on the way in which the allantois contracts its adhesions with the point of the ovum in contact with the womb. In fact, the placenta is always developed there, and if the allantois happens to strike the chorion at a point somewhat removed from that which is in apposition with the internal uterine surface, the umbilical vessels must evidently have a tendency towards the latter, just as the roots of a plant always stretch towards the spot which will afford them the most nourishment.

CHAPTER V.

OF THE FŒTUS.

We shall not attempt to study the fœtus by describing the different organs, and the various tissues successively, that enter into its structure at the moment of birth, nor by tracing each of them through the modifications it undergoes at the divers periods of the intra-uterine life; for such a course would evidently compel us to overstep the limits imposed by the nature and character of this work. Therefore, laying aside all embryological researches, we shall content ourselves with mentioning a few interesting particulars of *organogeny;* and while considering the fœtus in a general manner, we shall point out succinctly the successive development of its form and its external parts. But before entering upon this subject, we believe it will prove profitable to present, in a figure, the various details already furnished, as such an exposition will complete the description previously made, and facilitate a knowledge of the facts we have yet to speak of.

EXPLANATION OF THE FIGURES IN PLATE III.

Fig. 1. The human ovum, of its natural size, at about the thirtieth or thirty-sixth day.

Fig. 2. The same ovum (of its natural size) laid open to show its constituent parts.

A A. The chorion.

B. The amnion.

C. The fœtus.

D. The umbilical vessel.

Fig. 3. The same ovum highly magnified, and opened in such a way as to exhibit the principal relations existing between the embryo and its appendages. The walls

Pl. III

Fig. 1

Fig. 2

Fig. 3

T. Sinclair & Son, lith. Phila.

of the abdomen and chest have been cut away so as to bring the viscera into view, and the umbilical cord has also been split up, for the purpose of showing how the appendages of the fœtus are brought into relation with this latter.

A A. The chorion, consisting of two layers, placed back to back, and confounded with each other, but which have been dissected apart for a limited extent at A′ A′.

B B. The amnion, laid open, so as to show how it is continuous with the umbilical cord, along which it is reflected, thereby forming a sheath, which, under the form of the canal B′ B′, is directly continuous with the umbilicus or the abdominal walls C C of the embryo.

D. The umbilical vesicle, and D′ its pedicle.

D″. The point where this pedicle communicates with the intestine E.

E. The loop of intestine prolonged into the cord.

F. The urachus, continuous by one extremity, *g*, with the chorion, and by the other with the rectum at the point H.

i i. The umbilical arteries.

j. The umbilical vein.

j′. The part of the right auricle from which the umbilical vein comes off.

K. The vena cava inferior.

M. The inferior surface of the liver.

N. The omphalo-mesenteric vein.

O. The point where this vein empties into the umbilical vein.

P. The omphalo-mesenteric artery.

1. The heart.
2. The arch of the aorta.
3. The pulmonary artery.
4. The lung of the right side.
5. The Wolffian body.
6. The branchial fissure, which is converted into the external ear.
7. The lower jaw.
8. The upper jaw.
9. The nostril of the right side.
10. The nasal canal still forming a kind of fissure, which extends from the eye to he nostril.
11. The caudal extremity, or coccyx, projecting like a tail.
12. The upper extremity.
13. The lower extremity.

ARTICLE I.

DIMENSIONS AND WEIGHT OF THE FŒTUS AT THE DIFFERENT PERIODS OF INTRA-UTERINE LIFE.

At the time when the embryo first begins to be distinct, that is, about the third week, it is oblong, swollen in the middle, obtuse at one extremity, though drawn to a blunt point at the other, and straight, or nearly so, being somewhat curved forwards. It is therefore vermiform in shape, of a grayish-white color, semi-opaque, almost without consistence, and gelatinous, varying from two to four lines in length, and weighing one or two grains. At this period, the only trace of the head is a small tubercle separated from the rest of the body by a notch, but no rudiments of the extremities are observed, nor is there a cord at first.

The embryo is clearly surrounded by the amnion, which lies quite near it, in the form of a delicate membrane, leaving it, however, always free. The abdominal cavity is opened for a very considerable extent in front. The embryo becomes more consistent towards the *fifth week:* its head then

increases greatly, in proportion to the remainder of the body, and the rudimentary eyes are indicated by two black spots turned towards the sides; the development of the thoracic extremities is announced by two small, obtuse nipples, situated on the sides of the trunk; it is nearly two-thirds of an inch long, and weighs about fifteen grains; the cord exists in a rudimentary condition, and the abdominal members are likewise present, in the form of two rounded pimples. The vertebral divisions are quite apparent, all along the back, although the caudal vertebræ closely approach the front part of the head, in consequence of the anterior curvature of the embryo.

Already does the heart exhibit, in its external form, a tolerably close resemblance to that in the adult; for we may even now observe the fissure that will afterwards separate the auricles, as also one corresponding to the inter-ventricular partition; but there is, in reality, only one ventricle, from which both the aorta and the pulmonary artery arise. And, further, there is but one auricle; or, rather, the two communicate so freely that the intermediary contraction which should divide them is still very imperfect; for the partition is formed by the progressive contraction of the orifice of communication, and this incomplete opening, which sometimes persists in the septum until birth, is known under the name of the *foramen of Botal.* But, after birth, the opening becomes obliterated, and the two auricles are thenceforth isolated by a complete partition.

The single ventricle will be converted into two cavities, by the intervention of a septum, which will be gradually developed from the summit towards the base, being placed between the two arteries (the pulmonary and aorta), and so disposed that one of them shall open into the right and the other into the left cavity.

The lungs at this period are constituted of five or six lobules, in which we can readily distinguish the bronchial extremities, terminating in slightly swollen cul-de-sacs. Moreover, two large glandular structures lie along the vertebral column at this period, extending longitudinally on each side, from the lung to the bottom of the pelvis. These are the Wolffian bodies. They are constituted by an excretory canal, which runs throughout their whole length, being placed on their external margin, and terminating below in the transitory cloaca. The canal puts forth, on one of its sides only, a series of more or less elongated cœca, which roll or curl up, so as to form a considerable mass by their agglomeration. These cœca secrete a liquid, which is subsequently emptied into the cloaca by means of the canal.

The Wolffian bodies anticipate the function of the kidneys until the latter are developed, and hence they have been denominated the *false kidneys;* but they disappear as soon as the true organs can replace them, leaving no trace of their past existence. Just alongside of the excretory canal, in the Wolffian body, a second one is seen to accompany it throughout, and even in like manner to empty into the cloaca. But this second canal is perfectly distinct from the other, and will become, in the adult, either the oviduct or the vas deferens, according as the new being shall be of the male or female sex.

In the early stages of embryonic life, there likewise exists on each side of the neck in the human fœtus, as also in the mammalia, four transverse

fissures which open into the pharynx. These are separated from one another by certain bands, or fleshy partitions, that correspond with the branchial arcs of fishes; for the vascular apparatus distributed there affects, to a certain extent, the same form temporarily, that it has permanently in the inferior vertebratæ. We, therefore, see that the bulb of the aorta, instead of curving immediately in a single arch, divides, on the contrary, into three or four branches, on each side of the neck; and after these branches have each accompanied a branchial arch, they reunite, at a common point, to form the descending aorta; however, they are soon effaced, along with the corresponding fissures, and but two remain on the left side, one of which is converted into the arcus aortæ, while the other, after having existed as an arterial canal, will form the common trunk of the pulmonary arteries.

The branchial fissures just under consideration also disappear, with the exception of a single one (the first on each side), which is converted into the external ear, as may be seen in the figure. (See Plate IV.)

At this period, the upper jaw is still composed of two papulæ one for each side. These pimples, or isolated mandibles, gradually approach the median line, and there unite in a single body, which forms the jaw such as we find it in the adult.

The nostrils are separated by the incisive papulæ, which keep them apart for some time; then, as the latter diminish in size, they approach each other and assume their definitive form; but, in the meanwhile, they are separately split down to the mouth, and it is the permanence of this transitory state that constitutes the double hare-lip. All of the branchial fissures have disappeared by the sixth week, leaving only a slight cicatrix behind.

The first centres of ossification appear during the seventh week, first on the clavicle and then on the lower jaw. The intestine still extends for a considerable distance along the interior of the umbilical cord, but the omphalo-mesenteric canal is nearly obliterated, although it may yet be traced as far as the umbilical vesicle, where it is reduced to a very delicate thread. The anus remains closed; and the bodies of Wolff alone exist near the vertebral column. It is only then that the kidneys and capsulæ renales begin to appear, and soon after them the sexual organs. The urinary bladder is first manifested under the form of a tumor that is continuous with the urachus. At this time, the embryo is nearly an inch in length.

At two months, the tubercles of the extremities become more prominent. The fore-arm and hand can be distinguished, but not the arm; the hand is larger than the forearm, but it is not supplied with fingers. The cord has not as yet assumed a spiral arrangement, but it is infundibuliform in shape, the base corresponding to the abdomen, being continuous with it, and containing a large quantity of intestine; it is four to five lines in length, and is inserted near the lowest point of the abdomen. A small tubercle, furnished with one or more very contracted openings, may be distinguished between it and the termination of the spine, which are the rudimentary external organs of generation; but the extreme length of the clitoris renders the distinction of the sexes difficult at this period.

The embryo is from one and a half to two inches long, and weighs from three to five drachms, the head forming more than one-third of the whole.

The eyes are prominent, but the lids, from being still rudimentary, do not cover the eyeball; the nose forms an obtuse eminence; the nostrils are rounded and separated; the mouth is gaping, and the epidermis can be distinguished from the true skin.

At ten weeks, the embryo is from one and a half to two and a half inches in length, and weighs an ounce or an ounce and a half. The palpebræ, having become more apparent, descend in front of the eye, and the puncta lachrymalia are now visible; the buccal fissure, which has increased in size, begins to be obliterated by the commencing development of the lips.

The thoracic parietes are apparent; hence the heart's movements cease to be visible. The fingers are distinct, and the toes look like little tubercles held together by a soft substance. The cord is longer than the embryo, and begins to assume the spiral arrangement; it is less infundibuliform than previously, and is not inserted so low down on the abdomen, but its base always contains a portion of intestine.

At the end of the third month, the embryo weighs three to four ounces, and measures from five to six inches; the eyeball is seen through the lids; the membrana pupillaris is more manifest; the forehead and nose are clearly traceable, and the lips well marked and not turned outwards. The neck now establishes a visible separation between the head and thorax; the latter cavity is closed at all points, but is still very slightly developed relatively to the other cavities. The cord contains no intestine, and its spiral turns are more numerous and evident. The nails begin to appear as thin membranous plates; the sex is distinct, and the integuments, which heretofore were only a soft, viscous covering, acquire more consistence, but are still very thin, transparent, of a roseate hue, and without an apparent fibrous texture.

At the fourth month, the embryo takes the name of *fœtus;* its growth is not so rapid in the commencement as at the end of this month. The body is six to eight inches in length, and weighs from seven to eight ounces. The fontanelles are very large, as are also the sutures; and some short, whitish, silvery hairs may be observed on the head. The face still remains but little developed, although more elongated than it has previously been. The eyes, nostrils, and mouth are closed, and when the occlusion of the lids happens to be incomplete, it is generally at the internal part. The tongue may be distinguished behind the buccal fissure, and the projection of the chin is observable. The cord is inserted higher up on the abdomen, whence the centre of the body is an inch or two above the umbilicus. The skin has a rosy color, and begins to be covered by down; and some fat, tinged with red, is deposited in the areolæ of the subcutaneous cellular tissue, and the muscles now produce a sensible motion. A fœtus born at this period might live for several hours. Whilst I was Interne at the Hôtel Dieu, I received one that had scarcely reached the fourth month. It lived, however, from half-past seven to half-past eleven o'clock.

At five months, the length of the body is eight to ten inches, and it weighs from eight to eleven ounces. The skin is more consistent, and many patches of sebaceous matter may already be seen, but the pupils cannot be distinguished.

At six months, the length is eleven to twelve and a half inches, and the weight about one pound (avoir.). The hair is both longer and thicker, the eyes closed, the eyelids somewhat thicker, and their margins, as well as the eyebrows, are studded with very delicate hairs. Agreeably to most authors, the membrana pupillaris always exists; on the contrary, the pupil at this period has seemed very large, both to M. Velpeau and myself. The skin is better organized, for the dermis and the epidermis may be distinguished, though its surface is wrinkled and puckered, owing to the small quantity of subcutaneous fat. The nails are solid already. The scrotum is very small, quite red, and empty.

At seven months, the fœtus acquires a length of twelve and a half to fourteen inches; all its parts have become firmer and more voluminous, and their respective dimensions better proportioned. The bones belonging to the vault of the cranium exhibit near their centres a considerable prominence at the point where the first rudiments of ossification occur, whence it follows they are less uniformly arched than at the succeeding periods, and more curved than in the former months, when they were in reality nearly flat. The pupillary membrane disappears completely; indeed, according to M. Velpeau, this membrane does not exist at any period of the intra-uterine life. The iris commences as a simple ring, which then grows in a concentric manner, leaving at last only the opening called the pupil. The eyelids are partly open, and the testicles begin to descend into the scrotum.

At eight months, the fœtus seems to grow, as Desormeaux remarks, rather in thickness than in length; it is only sixteen to eighteen inches long, and yet weighs from four to five pounds. The skin is very red, and covered with long down, and a considerable quantity of sebaceous matter.[1] The lower jaw, which was at first very short, is now as long as the upper one. The scrotum usually contains one testicle, generally that on the left side.

Finally at term, the fœtus is about nineteen to twenty-three inches long, and weighs from six to seven pounds. Although, in consequence of the development at the inferior part of the trunk, the umbilical ring is now considerably removed from the hypogastric region, yet the insertion of the cord does not correspond, as has been stated, with the centre of the body. Thus, in a fœtus whose total length is twenty inches, we shall generally find ten and a half to eleven inches from the crown to the umbilicus.

Indeed, from the researches of M. Moreau, communicated to the Academy of Medicine, it appears that in ninety-four children born at nine months, four only had the umbilical insertion in the middle of the body, while in

[1] About the middle term of the intra-uterine life, the skin is covered by a constantly increasing mass of a fat, slippery, viscous substance, yellowish-white in color, called the sebaceous coat. This substance is more abundant on some embryos than on others, and is in greater quantity on certain places, as, for example, the head, axilla, and groins; it is insoluble in water, alcohol, and oil, and only partially soluble in potash. It is not a precipitate furnished by the amniotic liquors, as some persons have imagined, for there is none of it on the external surface of the amnios, nor on the umbilical cord; it is a secretion of the fœtal skin, and, so far as we can judge by its composition, is a mixture of effete epidermis and matters furnished by the sebaceous glands, which assist perhaps in the hour of labor by facilitating the expulsion of the child.

ninety others it was below this. The mean of the variations was nearly an inch. M. Ollivier, of Angers, has also observed the same thing in thirty children, examined by him.

The weight and length of children at birth have been wonderfully exaggerated in many cases; thus, some are recorded of a yard or more in length, and others that weighed eighteen, twenty, twenty-four, and even thirty pounds. These statements must certainly be great exaggerations; for the most voluminous of three thousand children, born under my charge, either in the Hôtel Dieu or at La Clinique, weighed ten pounds, and it was an enormous one.

Of four thousand children delivered at La Maternité, one only weighed twelve pounds. (Lachapelle.)

Baudelocque asserts, that he superintended the delivery of one of twelve pounds and three-quarters; and M. Merriman, one weighing fourteen pounds; Richard Crofts, another of fifteen pounds; lastly, Mr. J. D. Owens, a surgeon at Haymoor, near Ludlow, has seen a still-born infant that weighed seventeen pounds twelve ounces, and had the following dimensions:

Occipito-frontal diameter,	$7\frac{1}{4}$	inches.
Occipito-mental, "	$8\frac{1}{2}$	"
Bi-parietal "	6	"
Total length,	24	"

In the month of May, 1849, I was called in consultation by Dr. Riembault in a case of shoulder presentation. Several attempts at version had been made by himself and another physician, and it was with the greatest difficulty that I succeeded in accomplishing it. The child, which was born dead, appeared to me a very large one, and I estimated its weight at from ten to twelve pounds. After my departure, M. Riembault, who, like myself, had been struck with its size, weighed it carefully, once with a steelyard, and twice in different balances, and ascertained its weight, by the three trials, to be eighteen pounds. Its extreme length was two feet one and a half inches, the bi-acromial diameter nine inches, the greater circumference of the head sixteen and one-eighth inches, and the lesser circumference nine inches. M. Riembault has assured me repeatedly, that he could guarantee the accuracy of these statements, since being himself astonished at the results of the measurements, he had taken the precaution to repeat them several times.

The mother stated that her last menstrual period occurred July 12, 1848, and that she expected to be confined about the 12th of April, 1849. The size of the abdomen had been so great since March, as to lead her to suppose that she was pregnant with twins. The first pains were experienced on the evening of the 6th of May, that is to say, nearly a month later than she had anticipated. Whether the pregnancy had really run over its usual term, and whether the extraordinary size of the child was attributable thereto, are questions which it is impossible to decide.

On the whole, therefore, we may conclude that the fœtal growth is rapid for the first three months, then slackens off about the middle of pregnancy, and again becomes greatly accelerated during the last three months.

Chaussier has given the following as the proportions exhibited by the

different parts of the fœtus at birth (taken from a child nineteen and a half inches long), namely:

From the top of the head to the pubis,	$12\frac{1}{4}$ inches.
" the pubis to the feet,	$7\frac{1}{4}$ "
" the clavicle to the bottom of the sternum,	2 "
" the latter to the pubis,	$6\frac{1}{4}$ "

With regard to the *transverse* measurement, he found as follows:—

From the top of one shoulder to the other (bis-acromial or transverse diameter of the thorax),	$4\frac{3}{4}$ inches.
From the sternum to the spine (antero-posterior diameter),	$3\frac{3}{4}$ "
" ilium to ilium (transverse diameter of the pelvis),	3 "
" one femoral tuberosity to the other,	$3\frac{1}{2}$ "

We shall examine hereafter the dimensions of the head.

Fortunately, these diameters are reducible; thus, the *bis-acromial* in particular, which presents four and three-quarter inches, may be reduced to three and three-quarter inches, by compression.

ARTICLE II.

HEAD OF THE FŒTUS AT TERM.

The head of the fœtus merits the particular attention of the accoucheur, as being really the most voluminous and least compressible part of the child. It is, therefore, highly important to ascertain whether its several diameters are proportional to those we have heretofore studied in the pelvis. The head is likewise, in the majority of cases, the part which presents during labor; consequently, it is very necessary that we should be fully acquainted with all its characters, in order to recognize them at this period.

The fœtal head, considered as a whole, is ovoidal in form, the larger extremity being posterior, and the smaller anterior; as, in the adult, it is composed of the cranium and face; but as the latter does not claim a particular notice, we refer, for a knowledge of its different parts, to the works on anatomy. Several bones enter into the formation of the cranium; they are—

The *frontal.*—A symmetrical bone, forming the forehead, as well as the superior-anterior part of the face. It is divided in the fœtus into two portions.

The two *parietal.*—One upon the right, the other on the left side, meeting at the median line; they are situated upon the superior lateral parts of the head, and concur to form the vault of the cranium.

The *occipital.*—A symmetrical bone, constituting the posterior part of the skull, as also a portion of its base.

The *temporal.*—Two bones placed, one on the right, and the other on the left side, below and beneath the parietal, completing the lateral portions of the cranium and contributing to the formation of its base; lastly, the *sphenoid* and the *ethmoid*, which belong exclusively to the base. These bones are not united to each other at birth by serrated articulations, as they are in the adult (*immovable synarthrosis*), but are separated, those of the vault especially, by membranous intervals, of greater or less extent, accord-

ing to the degree of ossification. The intervals have received the name of *sutures*, or *fontanelles*.

This arrangement of the vault of the cranium have several advantages It facilitates the development of the brain, and what is hardly less important in the view of the accoucheur, it allows of a certain reduction of the diameters of the head. When the latter is compressed forcibly, the mar gins of the bones approach each other and may even overlap.

The extent of this overlapping is liable to be thought greater than it really is, for, as M. Malgaigne remarks, if we examine the matter closely we shall find that the membrane interposed between the parietal bones is too firm to be drawn out, and too narrow to permit a notable overriding; and further, that it usually maintains these two bones so close together, that the superior margin of one laps over the other, leaving even on the dried skull a true normal crossing. Some of those sutures, or fontanelles, are highly important in an obstetrical sense, and we shall next proceed to their consideration.

The Sagittal Suture.—This great or antero-posterior suture extends from the root of the nose to the superior angle of the occipital bone; being formed in front by the interval that divides the frontal bone into two halves, and in the middle, and posteriorly, by that between the parietals. At the superior and internal angle, formed by the two portions of the frontal bone, this suture is joined at the sides by the two *fronto-parietal* or *transverse* (coronal) sutures, which are formed by the space existing betwixt the superior border of the frontal and the anterior margin of the parietal bones, and crossing the former suture nearly at right angles.

Having arrived at the superior angle of the os occipitis, it seems to bifurcate, and give rise to two oblique lateral sutures formed by the posterior borders of the parietal bones, and the superior one of the occipital. These latter are called the *lambdoidal* sutures, probably from their resemblance to the Greek capital Λ (*lambda*). Just at the points where the fronto-parietal and the lambdoid sutures join the sagittal one, two membranous spaces, much larger than those just described, are found to exist, which have received the name of the *fontanelles*.

The great or *anterior fontanelle* is the one formed by the junction of the two transverse sutures with the sagittal. It is also called, from the fact of its corresponding with the bregma, the *bregmatic fontanelle;* in general, it presents an extensive surface, bounded by four bony angles, produced by the lateral sutures leaving it nearly at right angles. It is lozenge-shaped, and is usually much more prolonged into the frontal than between the parietal bones. Sometimes even, according to M. Gerdy, Jun., it scarcely ceases short of the nose, the margins of the coronal suture being parted throughout their whole extent by an interval which gradually diminishes from above downwards, being only about one or two lines wide toward the root of the nose. It is not at all uncommon to find at the lower part of this suture a rounded or oval membranous space, varying from three to seven lines in its diameter.

The *posterior* or occipital fontanelle is formed by the union of the two lambdoid sutures with the termination of the sagittal suture; it is smaller

than the preceding, and of a triangular form, being bounded by three bony angles. The lateral sutures leave it at an acute angle. The bony angles are generally found in contact, no membranous interval being left between them. Sometimes the two portions of the os occipitis are not fused into each other at birth, and in such cases a median suture exists, which separates them, and terminates in the posterior fontanelle. The latter has then a lozenge shape, and is subtended by four osseous angles, and can only be distinguished from the anterior by the obliquity of the lambdoidal sutures. The opposite condition is observed at times, the triangular space known as the posterior fontanelle not existing at all, because the projecting angle of the occiput then fits in and fills up the entering one formed by the parietal bones; still the convergence of the three sutures, and the prominence of the bony margins which overlap each other, will aid the diagnosis (Malgaigne); for when the head is engaged in the excavation, and has become strongly compressed, the superior angle of the occipital bones is completely concealed by the internal or supero-posterior angles of the parietals; and if the touch is resorted to under such circumstances, the finger can only recognize the position by detecting the little hollow formed by the depressed occipital angle. Of course, particular attention must be given in this case to the oblique direction of the lambdoidal sutures.

The not unfrequent existence of spaces upon the cranium, where the ossification is less advanced than usual, is another source of error. For this defective ossification is substituted a membranous expansion, which might be mistaken for a fontanelle.

Such an error might the more readily have occurred in the four cases of this kind which I have had an opportunity of observing, from the fact of the accidental fontanelle being situated just in the course of the sagittal suture, about equidistant from the anterior and the posterior ones; and as this point is precisely where the finger first falls, in practising the touch, we might mistake it for a fontanelle. But, by a little attention, it will always be easy to avoid this error, by ascertaining that no lateral sutures pass off from this membranous interval.

There yet remain some other sutures, and some other fontanelles on the inferior lateral parts of the cranium; but as they are devoid of interest we shall not describe them.

Diameters of the Head.—The term diameter has been applied to certain fictitious lines, which traverse the head in a determinate direction. To avoid over-loading the memories of students, we shall not multiply their number as some have done; but, following the example of M. Velpeau, shall describe only seven at first, as it will be very easy to supply the deficiency hereafter in treating of the mechanism of labor.

Seven diameters, then, may be distinguished for the fœtal head, which we divide, in order to facilitate their study, into the antero-posterior, the transverse, and the vertical.

1st. The antero-posterior diameters are: the occipito-mental, *a b* (Fig. 70), extending from the posterior fontanelle to the chin; this is the longest of all, being five and a quarter inches. The occipito-frontal, *d e*, which extends from the occipital protuberance to the frontal boss (also called the antero-

posterior diameter): it measures four and a quarter to four and a half inches. The sub-occipito-bregmatic, *c f*, extends from the middle of the space between the foramen magnum and the occipital protuberance (to the anterior fontanelle — *Transl.*), and is three and three-quarter inches.

2d. The transverse diameters are two in number: one, the bi-parietal, *a b* (Fig. 71), goes from one parietal protuberance to the other; it is from three and a half to three and three-quarter inches long. The other, the bi-tem-

Fig. 70.

Fig. 71.

poral, *c d*, passes from the root of the zygomatic process on one side to the same point opposite. It is two and three-quarters to three inches long.

3d. Lastly, there are two vertical diameters: first, the vertical diameter, properly so called, or the *trachelo-bregmatic*, *i g*, traverses the head perpendicularly, passing from the most elevated point of the vertex to the anterior part of the occipital foramen. It is three and three-quarter inches long. Professor Moreau points out another diameter, which he calls the cervico-bregmatic, *c h* (Fig. 70); this leaves the preceding somewhat obliquely, and runs from the anterior part of the occipital foramen to the anterior fontanelle; it is three and three-quarter inches in length; the second, the *fronto-mental*, or the facial, *d a*, extends from the frontal boss to the point of the chin. This is three inches.

Circumferences. — A circumference has been assigned to each of the above-mentioned diameters, since it is very easy to describe from the middle of every one of them, as a centre, a circle whose radius is equal to one-half of the diameter, and whose circumference shall pass through the two extremities of the latter.

As a matter of course, the greatest circumference of the head corresponds with the occipito-mental diameter, and passing at the same time obliquely over the sides of the face and through the extremities of the diameter, has a nearly horizontal direction.

Most authors describe it as dividing the head into two equal lateral halves, — a mode of regarding it, which, as M. Jacquemier judiciously remarks, is devoid of meaning as applied to obstetrical practice.

The occipito-frontal periphery, agreeing with the diameter of the same name, runs, horizontally, a little below the extremities of the transverse diameter, and separates the vault from the base. The sub-occipito-bregmatic circumference passes through the extremities of both the occipito-bregmatic and the bi-parietal diameters, being thus common to both.

The two latter are the most important of all, because they successively come into relation with the parietes of the pelvis in the progress of natural labor.

The circumferences belonging to the other diameters scarcely offer any interest, and we shall therefore merely mention them in passing; in number they equal the diameters.

The fronto-mental circumference, however, should be noticed as passing over the forehead, cheeks, and chin: being also called, on that account, the facial circumference.

The diameters just described, although but slightly reducible in their dimensions, are not absolutely invariable. Thus it is only necessary to witness a few difficult labors to become satisfied, that in such cases the head is most frequently elongated in the direction of the occipito-mental diameter, and flattened in its transverse one. And we further learn, from the experiments of Baudelocque, that the bi-parietal diameter (see art. *Forceps*) may be reduced one-fourth, or one-third of an inch, by the aid of instruments; indeed, we have even known this diameter to be diminished much more than that under the efforts of the womb alone, without any accident occurring to the child.

Independently of those variations in length of the diameters of the head in individual cases, which it is impossible to foresee, there is one which is almost uniform for each sex, and of importance to be acquainted with. The head of the male fœtus is generally larger than that of the female; the difference, according to Clark, being about the one-twenty-eighth or the one-thirtieth. This difference exerts a notable influence upon the duration of labor even in well-formed women, and may consequently have an injurious effect upon the health of the mother, and upon both the life and health of the fœtus.

Thus it is shown by the researches of Dr. Simpson: 1. That the majority of the children which die during labor are males: the proportion of still-born boys to still-born girls being as 151 : 100. 2. That of children born living, there are more boys than girls presenting some morbid condition, or some lesion produced during labor, and consequently more likely to succumb within the first weeks of their existence. 3. That of the mothers who die during labor, or in consequence of it, the majority have given birth to boys.

It will be readily understood that the sex of the child will have a still greater influence upon the result of the labor where the pelvis is slightly contracted; and that with the same diameters, the life of a male fœtus would be often compromised when a girl might pass with little difficulty and no danger.

We present, in the following table, the diameters of the fœtal head, as also those of the pelvis, before described; hoping that, when thus collected, their study will be rendered more easy:—

Diameters of the pelvis. (In inches.)	Antero-Posterior.	Transverse.	Oblique.	Sacro-cotyloid.
Superior strait, .	$4\frac{1}{2}$	$5\frac{1}{4}$	$4\frac{3}{4}$	4 to $4\frac{1}{8}$
Inferior strait, .	$4\frac{1}{2}$ to $4\frac{3}{4}$	$4\frac{1}{4}$	$4\frac{1}{4}$ to $4\frac{1}{2}$	" "
Excavation, . .	$4\frac{3}{4}$ to $5\frac{1}{8}$	$4\frac{3}{4}$	$4\frac{3}{4}$	" "

FŒTAL HEAD.

Longitudinal diameters, . .	Occipito-mental, .	$5\frac{1}{4}$	inches.
	Occipito-frontal, .	$4\frac{1}{2}$	"
	Sub-occipito-bregmatic,	$3\frac{3}{4}$	"
Transverse " . .	Bi-parietal, . .	$3\frac{1}{2}$ to $3\frac{3}{4}$	"
	Bi-temporal, . .	3	"
Vertical " . .	Trachelo-bregmatic, .	$3\frac{1}{2}$ to $3\frac{3}{4}$	"
	Fronto-mental, . .	3	"

The fundamental principles of midwifery are deduced from the correspondence between the fœtal dimensions and those of the pelvis. It happens, in fact, that the child at term can only clear the pelvic canal by presenting one end of its long diameter; that, whichever extremity this may be, the delivery will still remain impossible if the head should present in such a manner as to have its occipito-mental diameter *parallel* to those at the inferior strait; that, consequently, the occiput must always engage before the chin, or *vice versâ*; and, lastly, that the most favorable position of the head requires the latter to be strongly flexed upon the trunk, so that its smallest diameter (the sub-occipito-bregmatic) shall be parallel to the plane of the strait; and that to be in its most favorable relation with the pelvis, the occiput must correspond with one of the extremities of an oblique diameter.

The articulation of the head with the vertebral column, and the movements it permits, should also be carefully studied: thus, the occiput is connected to the atlas by a close union, which only admits the motions of flexion and extension, which in the fœtus are far more extensive than in the adult; the atloido-axoid articulation, on the contrary, being ginglymoid, only permits a rotation, which is limited to the fourth of a circle. Whence the conclusion is manifest, that whenever the head is caused to rotate—the body being fixed—great care must be exercised not to pass the limits indicated; for generally the fœtus would thereby suffer a mortal lesion. We say generally, not always, because two cases cited by Prof. Paul Dubois evidently prove that children may not only survive this accident, but even seem to experience no bad effects whatever from it.

The great laxity of the articular ligaments in the infant can alone explain the little danger attending an occurrence which would prove so disastrous in the adult. Finally, the natural situation of the head is such in the newborn child, that the chin descends much lower than the occiput, and the axis of the trunk traverses the cranium obliquely from base to summit, and from before backwards, passing a little in front of the posterior fontanelle.

ARTICLE III.

POSITION AND ATTITUDE OF THE FŒTUS.

The fœtus lies curved on its anterior plane within the bag formed by the membranes; usually, the head is somewhat flexed, the chin resting on the anterior superior part of the breast; the neck is so short that a slight degree

of flexion will, says M. Dubois, produce this effect; the feet are bent up in front of the legs—the latter strongly flexed on the thighs, and these again are applied to the anterior surface of the abdomen; the knees are separated from each other, but the heels lie close together on the back part of the thighs; the arms are placed on the sides of the thorax; the fore-arms are flexed and thrown across the sternum, so as to receive, as it were, the chin between the hands. The fœtus, thus folded on itself, constitutes a nearly ovoidal mass; the longest diameter of which is about eleven inches, having its larger extremity represented by the breech, which is turned towards the fundus uteri, while the smaller, formed by the head, is directed downwards. Now, it is evident that this constrained position could not have been produced by the mere pressure of the uterine walls on the child, since the latter is in a cavity much larger than its whole volume; hence, it must be referred to the individual itself.

Fig. 72.

The usual position of the child in the womb.

The pendent position of the head at term is so common, that we are naturally led to inquire why such should be the case? Formerly, it was supposed that, after having reached the uterus, the head occupied the fundus for the first seven months of gestation, and the pelvic extremity its inferior part; but that towards the expiration of this period, the fœtus reversed its position; the head approaching the orifice, and the breech going above.

This was the received doctrine until the arguments of Delamotte, Smellie, and more especially of Baudelocque, completely subverted it; and since then, it has been generally admitted that the fœtus, suspended, so to speak, in the amniotic fluid, by the umbilical cord, would naturally observe the law of gravity: that is, the head being the heaviest part would descend. This explanation was almost universally adopted, when M. Dubois, after re-examining the question, proposed another theory. He urged the following objections (whose value we fully acknowledge) against the influence of specific gravity, to which the great frequency of vertex presentations had been so uniformly attributed, viz.: 1. If a child be plunged into a considerable quantity of any liquid, contained in a bathing-tub, for instance, so that its descent will be very slow, in order to afford the head sufficient time to exert its superiority in weight, we shall find all parts of the fœtus to descend with an equal rapidity, and, consequently, either the back or one shoulder will first reach the bottom of the tub. This result, which is contrary to the general belief, is more in accordance with what is learned from an attentive examination of the fœtal structure; indeed, when a comparison is made, between the volume of the cephalic and the pelvic halves of the fœtus, it would naturally appear that their weight must be nearly balanced;

the cranial cavity, it is true, contains a well-developed brain, but the abdomen incloses the liver, which is no less so, as also the intestines and bladder, together with the meconium and the urine accumulated therein during pregnancy; 2. It is really impossible to believe that the fœtus is suspended by the cord alone, except during the early stages, for even at the third month the cord is longer than the greatest diameter of the uterine cavity, and therefore its insertion near the pelvic extremity can in no wise contribute to the more frequent presentation of the head; 3. Besides, those women who maintain the horizontal position during gestation on account of ill health, are not the less liable to exhibit the same phenomenon; 4. If the laws of gravity alone determined the position, the head being more voluminous relatively to the trunk, during the early months, the fœtus should present, in cases of abortion, by the cephalic extremity still more frequently than at term; but observation establishes the contrary; 5. Lastly, in animals the lowest part of the organ does not correspond with the neck, but rather to the fundus, of the womb; nevertheless, the fœtus is much oftener delivered by the head than the pelvic extremity.

After having tried to combat the generally received opinion by the objections just given, M. Dubois endeavors to prove that the vertex presentation is a consequence of the instinctive will of the fœtus itself. . . . . The child, in its mother's womb, has the faculties of perception and motion; for the regular and nearly constant succession of the perception of impressions, and the movements which follow, sufficiently indicate the same connection in the fœtus, between these two functions, that should exist after birth.

Now, the object of these fœtal movements are partly certain, partly presumptive; consequently, they may be regarded as really instinctive determinations; again, it is in consequence of such a determination that the head in the mammalia is usually found at that part of the uterus nearest to the pelvic outlet.

We frankly confess that M. Dubois seems to us more skilful in destroying than in building up; and though the reasons by which he combats the doctrine hitherto received appear very strong, yet those whereon he founds his opinion are not fully convincing. He is entitled to credit, however, for having sought, in a higher order of ideas, the explanation of a singular fact, which does not seem, in the present state of our science, capable of elucidation by the material reasons heretofore given.

If we might be permitted to hazard an opinion, after so many others, we should unhesitatingly say they have erred by seeking only in the fœtus, its form and structure, for the cause of the various positions which it assumes in the uterine cavity.

Already have several authors endeavored to account for the rarity of trunk presentations, by the vertical, or the nearly vertical direction of the long diameter of the uterus, which would naturally force the greatest fœtal diameter in the same line: for instance, the cause of trunk presentations, says Wigand, must be referred less to the fœtus itself than to a change in the ordinary elliptic form of the uterus. Now, by advancing a step further in the path they have marked out, may we not find a satisfactory explanation of the great frequency of vertex presentations in the form of the uterus,

and especially in its mode of development at the different periods of pregnancy? For, when we reflect that the uterus, being developed during the first six months at the expense of its fundus, is spread out superiorly, but, on the contrary, is much contracted below, does it not become evident that the pelvic extremity, which, from the folded condition of the lower limbs, is much more voluminous than the head, must naturally lie in the largest cavity, that is, towards the fundus; and, consequently, that the cranium will descend to the cervix? There can be no doubt that the inferior part spreads out in the last three months nearly as much as the fundus; but, then, the fœtal vertical diameter is too long to permit it to traverse the transverse diameter of the uterus; and hence, with some few exceptions, the child is forcibly retained in the position it first assumed.

Finally, can we not explain by this circumstance the position of twins, in cases of double pregnancy, where it frequently happens that one fœtus presents by the pelvic extremity, and one by the head? In a word, the child, shut up in its close sac, and constantly subjected to movement, must assume, not instinctively but mechanically, such a position as will bring its largest parts into correspondence with the most spacious portions of the organ.

ARTICLE IV.

FUNCTIONS OF THE FŒTUS.

The functions of the child, while it remains in the uterine cavity, that require our particular attention, are its nutrition, respiration, and circulation.

§ 1. Of Nutrition.

Few questions in physiology have given rise to more discussion than this of fœtal nutrition. However, it is universally admitted that the nutritive materials are furnished by the mother's body; but authors are not as unanimous in regard to the mode of their introduction into the interior of the product of conception. For instance, some think that the liquids secreted by the internal uterine surface transude through the membranes, so as to reach the amniotic cavity, to be there taken up by the fœtus. Others regard the maternal placenta as designed to supply the child with nutritive matter, and find in the umbilical cord the only means of conveying it.

It is necessary to admit at the outset, that there can be no discussion of the question until after the placenta is developed, or at least, until after connection is established between the mother and child by means of the allantois. Now, as nothing of the kind exists in the early periods of pregnancy, it must be acknowledged that during this time, at least, the maternal fluids must reach the fœtus by endosmosis through the membranes of the ovum.

The nutritive matters cannot all be derived from the same source at the various periods of gestation. Thus, when the ovule quits the ovarian vesicle, it carries with it a portion of the granules which formed the proligerous disk; and it is probable that these may subserve its nutrition during its progress through the first half of the Fallopian tube. In its passage through the other half, an albuminous matter secreted by the walls of the tube

envelops the ovule, and probably also penetrates through the vitelline membrane.

Arrived in the uterine cavity, the ovule comes in contact, at all points, with the mucous membrane of the uterus. The villi of the chorion undergo a considerable development, and until the placenta is formed, are all capable of imbibing the fluids secreted by the internal surface of the organ. As the canal with which each is provided opens into the cavity of the chorion, they are wonderfully adapted to this purpose; and notwithstanding the closure of their extremities, the uterine secretions pass by endosmosis through their thin walls; like the roots of a tree, they serve to convey the nutritive fluids into the space separating the chorion from the amnion. From thence, the nutritive juices transude through the walls of the amnion into its cavity. A certain portion of them is conveyed into the body of the fœtus through the canal of the umbilical vesicle.

But as soon as the vascular connections, which, as we have learned, are established between the maternal and fœtal placentas, begin to be formed, the non-placental villi of the chorion tend gradually to waste away; the development of the amnios obliterates the cavity which separated it from the chorion, and along with it also disappear the vitriform body and the umbilical vesicle. It now becomes a question, whether the nutritive matters supplied by the mother can penetrate into the amniotic cavity through the two membranes of the ovum, without collecting to an appreciable amount during the passage? Or, on the other hand, are they absorbed by the vascular radicles of the fœtal placenta, and introduced into the body of the embryo by means of the umbilical cord?

The partisans of the former opinion have endeavored to prove: 1, that the amniotic fluid is derived from the mother; 2, that it contains nutritive matter; 3, that it may enter the embryo in several ways.

A. It is almost certain that the fluid is supplied by the mother, for it is the more abundant as the child is less developed, and its quantity diminishes relatively to the fœtus, in proportion to the advancement of gestation. Now, the contrary should be true, were it a product of the fœtus itself. Besides, foreign matters introduced into the stomach of the mother, or injected into her veins, have been discovered in the amniotic cavity. It is also true, that they have nearly always been found at the same time in the blood of the embryo and in the placenta. So that, strictly speaking, it is difficult to say into what part they were first distributed. Very dissimilar observations having reference to this subject are on record. Thus, for example, in the case of an embryo of five months, the mother of which had been poisoned by sulphuric acid, Otto found that wherever the skin had come in contact with the amniotic fluid, it was of a reddish-brown color, and as hard as parchment. On the other hand, in the case of a woman four months pregnant, who had been poisoned by arsenic, MM. Mareska and Lados found, by analysis, traces of the poison in the body of the fœtus, in the uterus, and in the placenta, whilst it *could not be detected in the waters* of the amnion. Mayer, however, injected cyanide of potassium into the trachea of a rabbit, and afterwards discovered it in the amniotic fluid, the placenta, and the organs of the fœtus.

B. The amniotic fluid must be nutritive, for it contains albumen, osmazome, and some salts; in fact, young calves have been sustained two weeks on fresh amniotic liquor. Finally, the quantity of this fluid, and more especially that of the animal and nutritive substances found in it, is much diminished towards the end of pregnancy.

C. Supposing it to be furnished by the mother, and to possess nutritive properties, it remains to be shown how it is enabled to enter the body of the fœtus. There are numerous hypotheses in reference to this point.

The liquor amnii may reach the body of the fœtus in various ways.

1st. By *cutaneous absorption.* When the umbilical vesicle ceases to furnish nourishment to the embryo, the skin becomes developed, and, very probably, absorbs the surrounding amniotic liquid; it is even possible that the lymphatic vessels, which are highly developed in the fœtus, are formed as a consequence of this absorption, just as blood-vessels are called into existence by the circulation.

Brugmans proved this absorption by an experiment: thus, after having extracted several living embryos of animals from the waters of the amnios, he noticed that the cutaneous lymphatics were filled, and that those of the intestines were not so; then plunging the limbs, previously tied, into this liquid, he found, after the lapse of some time, the lymphatics below the ligature were filled with lymph.

The epidermis is so excessively thin, that it can offer no obstacle to the imbibition, and the liquor amnii itself contains a large proportion of water. Again, the sebaceous matter which covers the fœtus at birth, only becomes manifest at an advanced stage of pregnancy; and, lastly, this absorption has been directly proved in animals both by experiments and dissection.

2d. By *the intestinal canal.* Though the cutaneous absorption may suffice for the nutrition of the embryo, as is sufficiently proved by the birth of monsters and anencephalous fœtuses with closed mouths, nevertheless, it is highly probable that the child makes some efforts at deglutition, at least towards the termination of pregnancy, thereby determining the introduction of fluids into the intestinal canal. Thus, embryos may occasionally be observed executing motions of respiration with their jaws, during which the waters would necessarily be swallowed; indeed, in ova, that have been frozen after their extraction from the cow, an uninterrupted band of ice has been found extending from the mouth to the stomach. And when the meconium is mixed with the amniotic liquid, it is sometimes detected in the throat, pharynx, and stomach. Lastly, hair is occasionally found there, which could only happen as a result of deglutition.

Besides these two modes of absorption, by the skin and the intestinal mucous membrane, some physiologists have supposed this fluid might be taken up in other ways: thus, according to some, the mammary glands are provided with conduits that act the part of lymphatics, absorbing the waters, and carrying them to the thymus gland, to be there elaborated. Others suppose that the liquor amnii may enter the trachea and bronchia, and there undergo some modification which may render it suitable for nutrition. Lastly, Lobstein seems to think it might possibly enter through the genital organs. But all these opinions are merely hypothetical.

With all deference to their ingenuity, these hypotheses are still far from being satisfactory. The introduction of the liquor amnii into the intestinal canal as a regular and normal occurrence, is by no means proved by the facts cited in its support. It is, indeed, more than probable, that the movements of deglution which the child has been seen to make, were really respiratory efforts determined by the suspension of the placental respiration; also that the icicles, the hairs, and the meconium, found in the stomach, had entered it but a short time before the death of the child; in short, where the antecedent death of the mother, the compression of the cord, or the separation of the placenta had begun to produce asphyxia.

Supposing the cutaneous absorption of the liquor amnii to be proved by the experiment of Brugmans, it would still seem unequal to the development of the fœtus, which must have some additional source of nutrition.

Looking beyond the membranes, there evidently can be no other source of supply than the maternal placenta, and, in fact, many modern authors regard the placental circulation as the principal agent in the nutrition of the fœtus. It is unnecessary to suppose a direct communication between the maternal and fœtal vessels, in order to understand how that, by means of the extensive contact existing between the vascular apparatus of the two placentas, a transudation may take place of the more fluid parts of the maternal blood, which are absorbed and mingled with the fœtal blood; also that this transuded fluid being charged with oxygen is subservient to the hæmatosis of the fœtal blood, at the same time that it supplies it with nutritive material. (Van Huevel.) It may, perhaps, be allowed, that all of the villi of the chorion, in the midst of which the placenta is developed, may not be applied to the formation of the radicles of the umbilical vessels, but that some of them may continue to exercise their primitive functions, and still absorb the fluids secreted by the utricular glands of the utero-epichorial mucous membrane.

What we have already said regarding the structure of the chorial villi of the placenta lends countenance to this supposition; for we have seen (Fig. 68), that beside the vascular villi, some are found to be solid, and destitute of any ramification of the umbilical vessels, although still adhering by their pedicle, and communicating with a larger branch of the villus. This fact seems, indeed, to have been anticipated by some authors: thus, although Eschricht regarded the placenta proper as being in reality the respiratory organ of the fœtus, he supposed that the utricular glands of the womb secrete a fluid designed for the nourishment of the embryo, which fluid is taken up by other branches of the umbilical vessels than those by which the placental respiration is effected; MM. Prévost and Morin also regard the placenta as the organ in which the absorption of the plastic matters supplied by the mother is accomplished by the vessels of the fœtus. According to them, this fluid, which is deposited upon the internal surface of the womb, is taken up by the vessels of the cotyledons. Thus, in the ruminantia, if the ovum with its cotyledons be extracted from the womb towards the end of gestation, by which, consequently, the fœtal and maternal placentas are separated from each other, the separation being easily effected without laceration, a whitish fluid is discovered in the uterine

caruncles, and a similar one can be expressed from the vascular brushes of the cotyledons. However this may be, it is very probable that the nutritive fluids reach the fœtus through the umbilical vessels properly so called.

When mixed with the fœtal blood, the nutritive elements supplied by the mother, are, like the chyle in the adult, devoted to the development of the organs. Lee supposes, however, that they undergo certain changes, first in the liver, and afterward in the intestine. When thus brought by the umbilical vein into the large liver of the fœtus, these elements experience changes which result in the formation of a new albuminous and nutritive compound which is poured along with the bile into the duodenum; there the mixture is separated into a recrementitial part, which is taken up by the absorbents, as in the adult, and an excrementitial part, charged with carbon, which forms the meconium.

In fine, until the placenta is formed, the nutritive elements reach the interior of the ovum by means of endosmosis; at a later period the growth of the fœtus is maintained by an absorption through the skin of some of the nutritive matters contained in the liquor amnii, and by the assimilation of those which the radicles of the umbilical vessels take up in the placenta.

[It should be added, in reference to this subject, that in the fœtus, as well as in the adult, glucogenesis is one of the essential conditions of nutrition. After a fruitless search for glucogenous matter in the fœtal liver, M. Bernard found it in the placentas of the mammalia, being especially present in the epithelial layer of the inter-utero-placental mucous membrane. To the already determined functions of the placenta we have, therefore, to add this of glucogenesis, which would seem to replace the hepatic function in this respect during the earlier periods of embryonic life.

In the ruminantia, the glucogenic matter having become separated from the placenta, is found spread over the free surface of the amnion and chorion in the form of epithelium-like scales, which are easily seen, but which have not hitherto been understood. (Cl. Bernard. *Lecons de Physiologie*, 1855.—*Memoires de la Société de Biologie*, 1860.)]

§ 2. Respiration.

Does the fœtus respire in the amniotic cavity?

If something analogous to respiration in the adult be sought for in the functions of the fœtus, this question will doubtless be answered negatively; because the atmospheric air having no access to it whatever, the fœtal blood could not possibly obtain any elements from it. But does it, therefore, follow that the sanguineous fluid will experience no similar modification at any part of the circuit? Most physiologists think otherwise, and I share their opinion.

According to some, the liquor amnii is the modifying agent for the blood, and Beclard supposes that the lungs are the seat of such changes, the amniotic liquid reaching them through the air-passages. Agreeably to M. Geoffroy St. Hilaire, the whole surface of the child's body absorbs air, or a vivifying gas, like insects, by a species of air-tubes, or by minute fissures which exist on the lateral parts of the neck in young embryos. The resemblance between those fissures and the branchial apparatus in the fish has given rise to the belief of an analogous function; hence, they are called the *branchial fissures*.

But, says Bischoff, in the mammalia and man, these arcs never have an organization justifying in the least the supposition of their being intended for respiration; they never have internal nor external branches; nor do we ever see, as in the *branchia*, vessels distributed either on their surface or in their interior.

Latterly, M. Serres has attempted anew to explain how respiration may take place in the embryo before the placenta is fully formed. He says the breathing apparatus of the human ovule consists of the chorion, the two layers of the decidua, the liquid contained between the latter, and of a particular class of villi, called by him the *branchial*, which, after having traversed the reflected decidua, come into contact with this liquid. On the one hand, the reflected decidua is perforated by multitudes of foramina, which may be aptly compared to those on the cribriform plate of the ethmoid bone; and on the other, the chorial villosities, the *branchial* villi, entering the substance of this membrane, lodge in those openings, and thus are brought into immediate apposition with the liquid. M. Serres believes that this arrangement presents all the conditions of a branchial respiratory apparatus; but this mode of respiration only lasts during the first fifteen or twenty days of the intra-uterine life; because, as the embryo is developed and grows, one part of the villi of the chorion is transformed into the placenta, and the fœtal respiration in the uterus then commences the second time, as the placental respiration. Then the branchial function decreases, the apparatus atrophies and disappears: at first, the branchial villi of the chorion wither away; the cavity of the decidua is contracted; the liquid diminishes; and, finally, the two laminæ of the decidua being brought into apposition, unite and become confounded with each other.

This hypothesis, though ingenious, is evidently based upon badly observed facts, and cannot be sustained after the description of the decidua which we have given.

After the allantois is developed, the villi of the chorion, which have then become vascular, are in immediate contact with the hypertrophied vessels of the mucous membrane, and from this moment the fœtal blood derives therefrom the elements necessary to hæmatosis. In proportion as the contact becomes more intimate and extensive, the organization of the placenta progresses, and soon forms a compact mass, which is the seat of the placental respiration.

In fact, this body is formed throughout in such a manner as to establish the greatest possible approximation between the maternal blood and that of the embryo; and this mediate union, in which the two liquids are separated by fixed membranes, establishes between the fœtal and the maternal blood the same relation that is known to exist in the lungs of the adult, betwixt the venous blood and the atmospheric air: thus, in the pulmonary organs, the blood is brought within the influence of the inspired air; true, there is none of the latter in the after-birth, but the maternal vessels are found there in great abundance, whose exceedingly delicate walls remain for a long time in contact with the umbilical radicles, the parietes of which are also thin and transparent.

Therefore, if nothing but thin, transparent membranes divide the fœtal

blood from that of its mother, is it not possible for the first to communicate some of its elements to the second? for, does not the air act through the walls of the pulmonary vessels of the blood contained therein? And further, is not such a modification of the fœtal blood in the placenta sufficiently proved: 1st. By the early death of the child, when the umbilical cord becomes flattened from compression, and its circulation thereby arrested. 2d. By the pathological phenomena of asphyxia, which are always revealed by the autopsy in such cases. 3d. By the antagonism known to exist between the after-birth and the lungs; in fact, the new-born infant may dispense with the pulmonary respiration, so long as its connection with the placenta remains uninterrupted, and this communication may be broken without danger as soon as it respires through the lungs; if it breathe freely, the blood no longer passes along the cord, and, should respiration cease, it shortly flows anew. And 4th. By the difference in the blood circulating in the umbilical vein, and that in the arteries,—a distinction not very manifest upon simple inspection, but which has been detected by physical and chemical experiments. Now, in the adult pulmonary respiration, the blood not only absorbs a certain portion of oxygen from the air, but it also gives off some carbonic acid. Thus far, we have only learned that the fœtal blood derives from the placenta a vivifying principle; but we have not observed the separation of those materials from it, which may be unsuited to the nutrition of the child. We may state, however, that most physiologists believe the liver is destined to the performance of this last elaboration, and to the removal of its superabundant carbon and hydrogen, which latter are employed in the formation of the bile, and contribute to the complete development of the organ. We know, in fact, that the growth of the liver follows that of the placenta, that both have a perfect organization at the same periods, that the bile is a highly carbonized fluid, and that the liver has a similar chemical composition.

§ 3. Circulation.

A. The fœtal vascular apparatus exhibits certain anatomical peculiarities that do not exist in the adult, and which must be noticed, in order to render the account of the circulation comprehensible. Now, these characteristics evidently depend on the absence of the pulmonary respiration, for they disappear as soon as it is established; thus:—

1. It is well known that the heart in the adult is composed of four cavities: namely, a right and left auricle, and a right and left ventricle, each auricle communicating freely with the corresponding ventricle, but not with its fellow, being separated from it by a complete partition. In the fœtus this dividing wall exhibits an opening, called the foramen of Botal, which becomes smaller as the pregnancy advances, and is wholly obliterated after birth, in consequence of a valve being developed on its inferior margin which gradually diminishes the freedom of the passage, and is large enough at term to obliterate the orifice entirely.

2. In the adult, the pulmonary artery divides into two large branches, one for each lung: these ramify throughout its ultimate tissue, distributing therein the venous blood derived from the right ventricle; the blood is next

taken up by the radicles of the pulmonary veins and carried back by them to the left auricle. This vascular circle is interrupted in the fœtus, in which the two pulmonary arteries are very small, although their common trunk gives origin to a voluminous canal which opens directly into the arcus aortæ, and is called the arterial canal or the *ductus arteriosus*.

3. The abdominal aorta bifurcates, so as to form the primitive iliac arteries, and each of these again divides into two branches, the hypogastric and the external iliac. In the fœtus, the hypogastric seems to be continuous with a large vascular trunk called the *umbilical artery*, but this is nearly obliterated in after-life. The two umbilical arteries run forwards and inwards along the lateral and superior parts of the bladder, and soon curve forwards so as to reach the inner surface of the anterior abdominal wall, along which they ascend to the umbilicus, then pass along the cord, and ultimately ramify in the placenta.

4. Lastly, the fœtus further differs from the adult in having an umbilical vein, which, commencing by numerous ramifications in the placental tissue, traverses the whole length of the cord, and reaches the abdomen by passing through the umbilical ring; then, running upwards and to the right in the substance of the suspensory ligament of the liver immediately behind the peritoneum, it gains the horizontal or umbilical fissure of this organ at its anterior part, where it gives off a few branches that ramify in the right and left lobes. Just at the point where the two fissures of this viscus intersect each other, the umbilical vein becomes enlarged, and then divides into two branches: the posterior of which, called the venous canal, or *ductus venosus*, is a continuation of the primitive trunk, and goes sometimes to the vena cava inferior above the diaphragm, though at others it joins one of the hepatic veins, and the common trunk thus formed empties into the vena cava; the other branch is much larger, and runs to the right; it leaves the principal trunk lower down and more in front than the venous canal; then it unites with the vena portæ, producing a canal whose diameter is double its own. This is called the *canal of reunion*, or the confluence of the portal and umbilical veins. After a short course, this vessel subdivides and ramifies in the substance of the liver, anastomosing with the hepatic veins, which (as in the adult) finally reach the vena cava a little above the ductus venosus.

EXPLANATION OF PLATE IV.

THE FŒTAL CIRCULATION (Flint).

Plate IV., which is a diagram of the fœtal circulation, taken from Flint's Physiology, is sufficiently plain to give at a glance the relative position of the organs and the peculiar arrangement of vessels and valves.

The Eustachian valve, the foramen ovale, and the two auriculo-ventricular orifices, are represented by dotted lines.

The branches of the uterine iliac arteries which pass to the placenta, the ductus venosus, the umbilical vein, the Eustachian valve, the foramen ovale (*foramen Botal*), and the ductus arteriosus do not exist in the adult.

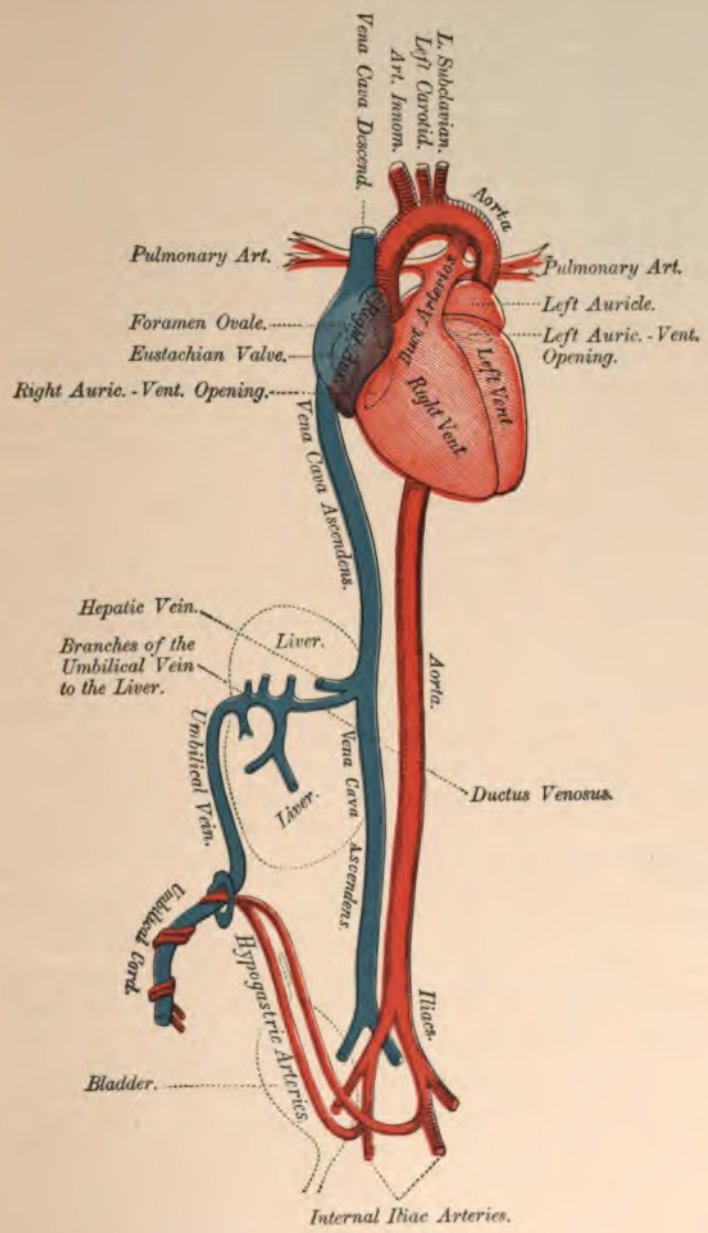


DIAGRAM OF THE FŒTAL CIRCULATION.

B. Now, having acquired these anatomical views, let us see what is the course of the blood in the fœtus. A part of this fluid, circulating in the umbilical vein, is, therefore, discharged by the venous canal directly into the vena cava; another part is distributed to the liver, where it probably undergoes, as before stated, some purification, and thence is brought back by the hepatic veins to the vena cava. Consequently, all the blood from the umbilical vein reaches the vena cava inferior either directly or indirectly. The blood contained in the latter is therefore a mixture of that which returns from the inferior extremities of the fœtus and of that poured into the liver by the vena portæ, with the addition of the portion contributed by the umbilical vein. This compound reaches the right auricle through the ascending vena cava, where it only mixes partially with the blood of the upper extremities, which has been brought back by the descending vena cava; because, in passing into the auricle, the ascending or inferior vena cava is directed towards the foramen of Botal, and hence its blood passes in a great measure through this opening into the left auricle, and thence into the left ventricle. By the contractions of this latter the fluid is then forced into the aorta, its impetus being broken against the great curvature of this artery; and the blood then passes into the vessels which arise from the arch, and is distributed through them to the head and superior extremities, a very small portion of it only reaching the descending aorta and the lower parts of the body.

The blood, after having thus supplied the upper half of the body, is collected by the veins, which, by their successive union, form the superior or the descending vena cava; the latter empties into the right auricle, where a small quantity of its blood mixes with that brought by the ascending cava; but much the largest part passes directly into the right ventricle, which forces it into the pulmonary artery.

This vessel sends but a trifling portion to the lungs; the rest being thrust into the ductus arteriosus, which discharges its contents into the aorta: that is to say, the blood that has contributed to the nutrition of the superior parts of the body, and has traversed the descending vena cava, the right auricle, the right ventricle, and pulmonary artery, and then has passed through the ductus arteriosus, finally mingles with the remnant of blood still existing in the descending aorta. The whole now descends to the inferior part of the latter vessel, where a small portion of it is sent through the arterial trunk to supply the inferior extremities, whilst much the largest quantity is driven into the umbilical arteries, and is carried by them back to the placenta: where, after having undergone the modifications produced by the placental respiration, it is again taken up by the radicles of the umbilical vein to once more traverse the same circuit.

C. *Of the Changes in the Circulation after Birth.*—It is difficult to explain the cause of the first inspiration; by some, it has been attributed to an instinctive movement of the fœtus, from the "*besoin de respirer*" (necessity of respiring) experienced by it, after a separation from the placenta; but these reasons are not satisfactory to me, for the air is only introduced into the lung as a consequence of the enlargement of the cavity of the chest, and not, as some imagine, to fill a vacuum which never existed. Now this

expansion of the chest has for its sole cause the violent, jerking, spasmodic contraction of the diaphragm, which is always the result of a suffering condition of the fœtus, caused by the suspension of the utero-placental circulation, the sudden impression of cold, or the different characters of the media to which the child is successively and rapidly subjected. Finally, also, by the artificial excitations (friction on the surface, irritation of the mucous membranes, &c.) resorted to when the infant is feeble.

As soon as the respiration becomes established, the sanguineous current takes another direction; because, on the one hand, the fluid flows towards the lungs in greater quantity; and, on the other, the placental circulation is forcibly interrupted. Below, I subjoin the results of the labors of Billard, who has devoted particular attention to the modifications then observed in the organs of circulation, as they are interesting alike to the accoucheur and the medical jurist.

The fœtal openings are generally obliterated in the course of a week after birth, still, they may remain patulous at that age; and, I may add, that either the foramen of Botal or the arterial canal may continue pervious at two or even three weeks, without the child's experiencing any particular disadvantage therefrom during after-life.

The umbilical arteries are usually closed on the second day; even at twenty-four hours they have already become smaller in the vicinity of the ring, and they are obliterated by the third or fourth day as far as their junction with the hypogastrics, by gradually changing into a fibrous cord; the whole process being completed in three weeks.

The umbilical vein is never obliterated until after the arteries have become impervious, and the same is true of the ductus venosus; however, both are quite empty, and considerably contracted on the fourth day, and they are generally closed up by the sixth or seventh.

The arterial canal and the foramen of Botal are the last to undergo this process; but they rarely persist beyond the eighth or ninth day, although the foramen sometimes remains open much longer, being only effaced completely towards the end of the first year.

If the ductus arteriosus and the umbilical arteries be examined during the progress of obliteration, their parietes will be found to grow gradually thicker; this hypertrophy is particularly observable in the arteries near the navel, as may be easily verified by making sections of them at this point; but the thickness gradually diminishes towards their origin from the iliacs, and their canal is likewise obliterated precisely in the same order of progression. Of course, the contractility of its walls will also contribute towards effecting the occlusion.

The arterial canal undergoes a similar hypertrophy and parietal retraction, which takes place in such a manner that, whilst the absolute size of the vessel does not appear diminished, its orifice is greatly contracted, resembling a pipe whose fracture is quite thick, and opening at its centre of very moderate calibre. The obliteration is therefore the immediate result of the retraction and concentric hypertrophy of the walls; nevertheless, it should not be regarded as the primitive cause, for if the same quantity of blood flowed into those vessels, such a retraction evidently could

not take place; but from the very first inspiration, this fluid is driven by the contraction of the right ventricle (see hereafter) almost entirely into the pulmonary arteries, scarcely any of it passing by the ductus arteriosus; and, on the other hand, the very oblique angle at which the umbilical arteries pass off, satisfactorily explains why the blood, that flows into them in such great abundance when it has no other outlet, no longer enters them at all, or at least only very feebly, when the establishment of respiration has completed the vascular circle of the new-born child.

But the umbilical vein and the ductus venosus are not obliterated in this way, and their walls exhibit no remarkable increase of thickness; for, after the cord has been cut, these vessels receive no more blood, excepting in those cases where it regurgitates from the vena cava, and then the walls fall in and become contiguous, just like any other canal, when the liquids that habitually traverse it are cut off; nevertheless, the umbilical vein and the ductus venosus retain their cavities free for a long time, for a large probe may easily be introduced into them; but this cannot be done in the arteries nor in the ductus arteriosus.[1]

The foramen of Botal is the last to disappear, although an effort at obliteration may be observed there sooner than in any other of the fœtal openings: thus, the two auricles are nearly confounded in one in the early stages of intra-uterine life, and the diminution of the foramen ovale only begins to take place about the third month by the development of a semilunar valve on its inferior border. This valve, composed of a double membranous layer, containing fleshy fibres in its substance, gradually rises along the margins of the opening towards the left auricle, by contracting adhesions with the circumference of the foramen, and it ultimately forms the fundus of the fossa ovalis, as also, the little semilunar fold seen in the auricle. In this way the partition is completed, being merely perforated by an oblique canal occasionally found in young subjects, which also disappears after a time.[2]

The following summary will enable the reader to appreciate the influence of these vascular changes upon the circulation.

Immediately after the first inspiration, and from the sole fact of the distention of the pulmonary cells, the branches of the pulmonary artery, ramifying in the mucous membrane, and contributing to the formation of their walls, are suddenly rendered permeable throughout their whole extent, and a vacuum is therefore produced, into which the blood is sent from the right ventricle; consequently, from that period, the route travelled by this

[1] A case of persistence of the umbilical vein in the adult, which communicated at one extremity with the vena portæ, and at the other with the crural vein through the superficial abdominal veins, is reported by M. Cruveilhier, in the 16th number of his *Pathological Anatomy*.

[2] According to Dr. Tyler Smith, the expansion of the lungs produces a compression of the ductus arteriosus by the left bronchus, and thus assists in its obliteration. The change effected in the position of the heart also aids mechanically the occlusion of the foramen ovale; and finally, the depression of the liver by the respiratory act, closes the umbilical vein by flattening its walls. (*The Lancet*, Sept., 1848.) None of these assertions appear to us sufficiently well proved, and therefore demand further investigation.

fluid, from the right ventricle to the aorta, is much longer than heretofore, and the ductus arteriosus, being thus emptied, will retract at once, and have its calibre very much diminished.

The right auricle, which could scarcely force all the blood that it received from the venæ cavæ, through the foramen of Botal, now sends the most of it into the right ventricle.

Prior to birth, the left auricle only received the blood by the foramen ovale, but it is henceforth filled with that brought through the four pulmonary veins. Moreover, the relation that existed, in the quantity of the blood deposited in each auricle, is changed from that time; for the right, which was distended beyond measure, now relieves itself with facility, while the left, that scarcely received any before, is filled with the blood brought by the pulmonary veins; so that it would flow from the left to the right auricle, through the foramen ovale, if the semilunar partition, which acts as a valve, did not prevent such a movement.

[§ 4. Innervation.

Most of the encephalic functions remain, according to M. Jacquemier, entirely dormant during intra-uterine life. Sensibility, however, becomes highly developed in the fœtus at quite an early period; in proof of which it is only necessary to press upon the womb through the walls of the abdomen, when the fœtus will be found to move for the purpose of avoiding compression.

A more direct experiment may be made as follows. If the abdomen of a pregnant rabbit be opened, the fœtus will be visible through the transparent walls of the womb, and a foot may be readily caught and compressed by a pair of forceps. When this is done, the fœtus moves in such a manner as to leave no doubt that it feels a certain degree of pain; for its action could not be regarded a merely reflex phenomenon. Spontaneous motions are caused by instinct or a vague and obscure exercise of volition.

During intra-uterine life, therefore, and especially near the end of gestation, innervation is almost as perfect as in the new-born child.

The functions of the fœtal nervous system present, like those of the adult, an intermittent action or periodicity, resembling the waking and sleeping states.

When a new-born child is asleep, if it be awakened and excited briskly several times with the tip of the finger, it will, at the moment of awakening, almost always make some abrupt motions. The same thing takes place, no doubt, during intra-uterine life, so that when we try to produce active movements by compressing the uterus, it is probably aroused from the sleeping to the waking state, and just then the hand on the abdomen becomes conscious of the actions elicited.]

§ 5. Secretion.

As it is not our intention to treat of all the various secretions which occur in the fœtus, we shall confine our remarks to those of the bile, meconium, and urine.

1. *Secretion of Bile.*—The liver is the most voluminous of all the fœtal organs. At three months its texture is soft and pulpy, not yet having the granular character visible at term; the gall-bladder at that period resembles a white thread, its inferior extremity being the largest, and its cavity exceedingly contracted. At five months the volume of the liver is much greater, the texture more condensed, and the gall-bladder more apparent; the secretion of bile then begins, and continues to augment thereafter

throughout pregnancy. We have just stated what appear to us to be the principal elements of the bile. At the seventh month, the gall-bladder is filled with a yellow secretion, and a considerable quantity of this is also found in the intestinal canal.

2. *Meconium.*—During the early periods of the intra-uterine life, the digestive canal is merely moistened by a little fluid, but a more abundant secretion begins to take place towards the third month. According to Lee, the stomach then contains a clear, acid, and non-albuminous fluid; whilst at the upper part of the small intestine a substance similar to chyme is found, consisting of pure albumen, and there is an analogous albuminous liquid in the biliary duct. The meconium exists in the small intestine only, prior to the fifth month, and is of a greenish-brown color, but after that period it reaches the large intestine, becomes of a darker hue, and finally accumulates in the rectum. This fluid is a mixture of bile with the products secreted by the intestinal mucous membrane.

3. *Urine.*—The urine never fills the bladder entirely in the human embryo; now, as the kidneys are developed early, and their secretion commences at once, the urine must certainly be evacuated by some outlet. On this account, certain embryologists have supposed that the bladder communicated originally with the allantois by means of the urachus, and that the cavity of this membrane was the ultimate reservoir of the urine. However, this is not the generally received opinion, for, as we have elsewhere proved, the allantois ceases to exist in the human species as a distinct vesicle long before the development of the kidneys; and the urine must therefore be expelled through the urethra into the amniotic cavity.

That its evacuation is necessary is proved by the facts already cited, in which the existence of an imperforate urethra led to extreme distention and even rupture of the bladder.

CHAPTER VI.

DIAGNOSIS OF PREGNANCY.

THE signs of pregnancy are divided into the rational and the sensible.

The first comprise all those characters pointed out by authors as existing in the earliest periods, by which they assert a conception may be justly suspected; then in the subsequent stages,—the suppression of the menses, the enlargement of the abdomen, the pouting of the navel, the phenomena just studied in the breasts, the symptoms, or rather the functional disturbances in the digestive organs, the condition of the pulse, the modifications in the urine, and lastly, certain changes that occur in the woman's habits, as well as in her moral and intellectual faculties.

§ 1. RATIONAL SIGNS.

According to Aristotle, there is some ground for believing the woman has conceived, if no fluid oozes out from the vagina after coition, and if the

penis is unusually dry when withdrawn; and the opinion seems to be universally received by shepherds, that the retention of the semen is an evidence of impregnation. Agreeably to Hippocrates, the eyes become more sunken, more languishing, and are surrounded by a bluish circle, and spots of different sizes appear on the face. Again, since the days of Democritus, a swelling of the neck is also enumerated as a sign of conception. However, all these symptoms have but little, if any value, and I accord far greater importance to the more voluptuous sensation, the more general erethism experienced by some females during a prolific coition, by which a few of them can recognize with a degree of certainty that they have become pregnant.

1. *Suppression of the Menses.*—Females cease to be regular during pregnancy; and this is a law of such general truth, that whenever it occurs in a healthy woman, without a known cause, and not attended with, or followed by any morbid symptom, it is justly regarded as a probable sign of gestation; but as this suppression might be produced by a number of other causes, whenever a physician is consulted about it, he ought carefully to inquire into all the circumstances, past or present, which may have produced such an effect. It would be out of place now to enter into this diagnosis, but we may reiterate an observation, already made by several authors, and which our experience has frequently verified, namely, that in some young married women, who had hitherto been quite regular, the menses become at once suppressed, and continue so for several months, without any known cause; and this suppression, resulting probably from the irritation or derangement produced in the genital organs by the first conjugal approaches, is frequently accompanied by an augmented volume of the abdomen, and a more exalted sensibility of the mammary glands; and, as the mind so readily believes what it most ardently desires, nothing more than this is wanted to found a hope of a commencing pregnancy. Hence the physician must exercise great discretion in his diagnosis, when consulted on so delicate a subject.

The menses may continue during pregnancy; thus they frequently appear in the earlier months, more rarely during the first five or six months, and what is still more unusual by far, they may exist during the whole period of gestation.

Numberless observations of this kind, recorded by authors, prove the truth of these assertions, and we also can bear testimony to the same point; thus, we saw some females in 1837–38, who were evidently pregnant, and in whom the menses flowed at the usual periods, and lasted for the same number of days; one of them assured us that she menstruated during the first five months, and that her courses appeared on the second of each month, and lasted for two days, just as she had them previously. Again, two females came under my observation at the Hôtel Dieu, whose cases have been already published in my thesis, who were regular throughout the whole term of pregnancy. Dunal (of Montpellier), Haller, and Mauriceau likewise cite similar cases; but notwithstanding all this, some accoucheurs still deny that women can be regular whilst pregnant.

M. Moreau, who professes this belief, has, however, often known females

to have sanguineous discharges at variable periods during gestation, but the irregularity of their appearance, the qualities of the blood itself, and the greatness or smallness of its amount, serve to distinguish these, in his estimation, from a true menstrual discharge. The remark of M. Moreau is certainly applicable to many cases, but the instances above cited, and numbers of others that might be quoted from various writers, do not permit me to entertain a doubt that a woman may menstruate during pregnancy.

On the other hand, females may become pregnant without ever having had their menses;[1] and the same is true of some others in whom they are suppressed either by accident, from the progress of age, or in consequence of nursing.[2]

All those anomalies will be understood without difficulty, if we do but recollect that, although the appearance of the menses is always connected with the ovarian evolution, the latter may take place without being accompanied by the menstrual flow. (See *Menstruation.*)

Deventer, Baudelocque, and Chambon furnish accounts of women who were regular only during gestation; the case cited by Deventer is particularly curious, from the opportunity he had of observing this fact in four successive pregnancies of the same woman. Finally, Desormeaux believes from his observations, that in certain years, and often without any apparent cause, a greater number of women have their menses during gestation, even where they were completely suppressed during former pregnancies. Does this result, as he appears to think, from atmospheric influence, or is it pure chance? For my part, I am unable to decide the question.

Though it is important to be aware of these exceptional cases, it is equally necessary to guard against the general tendency to a belief of the marvellous. It should not be forgotten, that the continuance of the menses during

[1] A young woman presented all the signs of pregnancy, and although she had never menstruated previous to that period, her courses then appeared and continued during the whole of gestation. (Perfect, *Cases of Midwifery*, vol. ii. p. 71.)

A lady, aged twenty-four years, during eight of which she had been married, was never regular except during pregnancy, and each appearance of her menses proved to be a certain sign of that condition.

A woman, who married at twenty-one, had never been regular; two years afterwards she experienced some gastric distress, and the flow appeared. Nine months subsequently, she was delivered of a healthy child, notwithstanding the menses did not fail to appear every month. (Churchill, *Observ. on the Diseases of Pregnancy*, p. 36.)

[2] Dr. Flechner, of Vienna, relates that a young woman of twenty-two, had always been regular, but the menses never reappeared after the first accouchement, being replaced each month by an intense headache, accompanied with a feeling of oppression and heat in the forehead and parietal regions. During the succeeding thirteen years, she gave birth to six healthy children. (*Gaz. Méd.*, p. 91, 1841.)

Dewees states, that a woman who had been married for several months, suffered some gastric distress. She had never been regular but three times, and for a number of years there was a complete suppression. He directed rhubarb pills, which purged her slightly, but did not relieve her; six months afterwards, the abdomen being somewhat enlarged, he was enabled to ascertain that she was six months advanced in pregnancy; and soon after the menses returned, and continued regularly until term. During lactation, which lasted a year, the courses did not appear; she then weaned the child, and in a short period again became regular, and this, like the former, was the announcement of a new pregnancy.

pregnancy is of rare occurrence, and that, although their suppression is of great value as a point of diagnosis, it may nevertheless be the result of a variety of causes.

2. *Enlargement of the Abdomen.*—An increase in the size of the abdomen may be produced by so many different causes that its slight value as a sign will be readily foreseen. There is, however, something peculiar in its shape and mode of development in gestation. Thus the abdomen swells somewhat in the first month, but this is owing to a collection of gas in the intestinal cavity, which, after remaining a few weeks, diminishes and disappears, whence the woman often seems smaller at the end of the second month than during the first; but whenever this slight tympanitis is not manifested, the abdomen is flatter the first month than before, probably because the uterus settles down in the excavation. At the beginning of the third month, or at three months and a half, the hypogastric region evidently becomes more salient, and the enlargement is thenceforth regular and always increasing until term. Consequently, the tumefaction begins to show itself just above the symphysis pubis, being more considerable at first on the median line than elsewhere, while the sides appear flattened; after the fourth month, the upper extremity of the uterine tumor may be clearly perceived through the abdominal wall, especially in thin subjects, by placing the woman on her back and the abdominal muscles in a state of relaxation; but if the parietes be thick and tense, palpation, practised in the manner hereafter described, will become necessary to ascertain this point.

The modifications in the size of the abdomen, at different periods of gestation, have already been described; but its development is not always regular, being, for instance, much more rapid in twin pregnancies, and in dropsies of the amnios than in other cases. Besides, the relation between the volume of the abdomen and the stage of pregnancy, is not always maintained; thus, some women are no larger at seven or eight months than others are at five, owing either to their high stature, their breadth of pelvis, or the small degree of projection in the vertebral column and upper part of the sacrum. On the contrary, in small women, more especially in those having a contracted pelvis, and in whom the womb is therefore necessarily raised, during the early months, above the superior strait, the abdominal protuberance is premature, if I may so express it, and is much better marked at quite an early period than ordinary.

The *umbilical depression* at first appears deeper, its bottom seeming to be drawn downward and backward in consequence of a tension of the urachus, occasioned by the fundus of the bladder following the descent of the uterus in the excavation. The circumference of the ring becomes at the same time the seat of a distressing dragging sensation, and is more sensitive to pressure; and this sensibility is sometimes extended over a considerable portion of the abdominal wall. But about the end of the third month, that is, as soon as the uterus gets above the superior strait, the umbilicus resumes its normal condition; at the fourth month, it is less hollow than before conception—then its bottom becomes more and more superficial during the fifth and the sixth, and the whole depression is effaced, and is found on the same level as the skin by the seventh month, and in some cases, the umbilical

ring is sufficiently dilated to receive the end of a finger; finally, in the last two months, the navel forms a protuberance. Not unfrequently, small portions of the epiploon become engaged in the ring during the exertions of the female and project externally.

These changes in the umbilicus afford a rational sign of great value, because they are almost constant. I say almost, for in a case observed by M. Blot, there existed a depression three-eighths of an inch in depth, the woman being at term and of ordinary embonpoint. Though these alterations of the umbilical depression may be produced by a pathological tumor of considerable size, or by an accumulation of fluid in the peritoneum, it is equally true, that they almost always exist in advanced pregnancy, and that their absence is, in a majority of cases, conclusive against the existence of a fœtus of seven or eight months.

3. The presence of the streaks, and especially of the brown line, which extends, as we have stated, between the pubis and umbilicus, is very important to the diagnosis, especially in a primiparous female. The streaks, however, may be present whenever the abdomen has suffered great distention from any cause whatever.

4. The phenomena presented by the mammæ afford, in the opinion of Mr. Montgomery, a *certain* sign of pregnancy. Smellie and Hunter also considered the changes in the areola as a positive evidence of this condition. The latter surgeon, indeed, did not hesitate on one occasion, when examining a dead body, to declare from this sole indication, the uterus to be enlarged by the product of conception; as the examination proceeded the hymen was found intact, but even this did not change his opinion, and when the womb was opened its correctness was fully confirmed. This fact, with many others which might be cited, prove the value of these signs when they exist, which unfortunately is not always the case; any one of them, indeed, may be wanting, and sometimes they are totally absent. Thus, in 1837, I saw a strong and vigorous young brunette at *La Clinique*, who had advanced to the end of gestation, without any of the indicated marks appearing around the nipple; and I have since made the same observation on several different occasions. Their absence is not therefore an absolute proof of the non-existence of pregnancy, so that their importance in this respect has been exaggerated by some English surgeons. These cases, however, are rare, and I should diagnosticate as almost certain the existence of pregnancy in a young woman who had never borne children, and whose breasts presented both a brownish-colored areola, the tubercles, and the freckled characters before described. But in those who have had children, it is very difficult to determine whether these signs result from the modifications of the breast in former pregnancies, or from a new conception. In such cases we have only the testimony of the women themselves to rely on, and this more especially, if but a short time has elapsed between the last and the present gestation.

[We have examined a young woman in whom both vagina and uterus were absent, although the external genital parts were well formed. Pregnancy in such a case is evidently impossible, yet here the true areola was of a very dark color, and the dotted one very decided. Still, the deepened color of the breasts, when

well marked, is a good rational sign, though its absence is far from disproving the existence of pregnancy. In brunettes, the true areola almost always darkens as the dotted one forms. Such, however, is not the case with blondes, in whom the color of the breasts is far less decided, and in women of a ruddy complexion it is generally absent even at the end of gestation.]

5. I have never been able to appreciate the reputed value of the signs founded on the state of the pulse of pregnant women, for although it has always seemed more developed, fuller, and harder, I could discover nothing further concerning it.

6. The disorders of digestion, as well as of the moral and intellectual faculties, are of but secondary diagnostic importance; they can do little more than direct the attention of the possibility of a doubtful pregnancy, but as they belong more properly to the pathology of gestation, they will be studied hereafter.

7. *Alterations of the Urine.*—Having treated at length of the production of Kyesteine in the urine of pregnant women, we merely state here that its presence is not as certainly diagnostic as some authors have supposed. Yet its existence in the urine of an otherwise healthy woman is an important rational sign.

Finally, it will be perceived that no one of the rational signs whose diagnostic value has just been discussed is conclusive, when taken singly; excepting, however, the changes undergone by the breasts, which, if well marked in a primiparous female, may of themselves remove all doubts as to pregnancy.

But although, singly, these various signs may only give rise to doubts, their union furnishes a sum of probabilities nearly equivalent to certainty, a certainty which, however, could never be complete until after a determination of the sensible signs, which we shall next proceed to examine.

§ 2. Sensible Signs.

All the sensible signs of pregnancy are derived either from auscultation or the touch. Hence, we must carefully study these two means of exploration, as well as the results which they furnish.

A. *Of the Touch.*—The *touch*, considered in an obstetrical sense, is the art of ascertaining the condition of the various hard and soft parts in the female, which contribute to the great act of reproduction; and it consists in the exploration of those parts by aid of the finger and hand applied to the vulva, vagina, and rectum, or upon the abdomen.

The touch is practised under various circumstances, for the purpose of ascertaining the existence and stage of the gestation; the imminence of an approaching accouchement; the progress of the travail; the presentation and position of the fœtus; the nature and energy, or the feebleness of the contractions; and the character, volume, and situation of obstacles presented by the hard or soft parts, which might prevent the spontaneous termination of labor, and demand the resources of art. The fact that any moment in the life of the accoucheur may call for its exercise, is of itself an evidence of its great importance, and of the necessity for practising it. With some experience, any one, whatever be the shape or size of his finger,

may acquire such a degree of skill in the touch as will bear him through the most difficult cases in practice.

Let no student, therefore, be disheartened by the difficulties met at the commencement, or by the groundless fears of too short a finger, for *this becomes longer by exercising the touch;* and those pedants are unworthy of credence, who seize a hand, and after examining it gravely, reject it with disdain, exclaiming, "You will never be an accoucheur with such a hand as that." Women, generally, have shorter fingers than ourselves, yet they become very perfect in the touch; and I repeat, that, unless there is a malformation of the hand or fingers, anybody may learn by practice to touch, and to touch well.

1. *Vaginal Touch.*—The index-finger is usually employed for this purpose; after being extended, it is entered horizontally in the fissure between the nates, until arrested by the soft parts, and the index is then drawn forwards, as far as the opening of the vulva. I prefer this method to the one in which the finger is carried from before backwards, in such a manner as to pass over the clitoris and the meatus urinarius, because friction against these parts should always be avoided with the greatest care. In bringing the finger from behind forwards, it would not be possible, except through gross negligence, to confound the anal orifice with the vaginal opening, and this being once found, the index is first pressed almost directly backwards, until one-third of it has penetrated into the vagina, and then by strongly depressing the wrist, the operator gives his finger a nearly vertical direction, so that the thumb may be applied against the anterior face of the symphysis, the radial border of the index be directed in front, and its cubital border be placed against the anterior perineal commissure, which it serves to push backwards. The other three fingers vary in position, according to the case, and more especially to the object in view; for example, if desirable to explore the parts situated on the posterior plane of the excavation with the index, it is better, in my opinion, to extend them on the perineum, pressing the latter up by the radial border of the medius; but if, on the other hand, we wish to perform the ballottement, or to explore the parts on the anterior plane, it will be more convenient to flex the thumb and the other three fingers into the palm, the index alone being extended, with its palmar portion directed in front. Stein directs the medius to be joined with the forefinger, but this is generally useless, and often inconvenient, for although the two fingers may possibly penetrate a little deeper, the sensation is not so clear as that obtained by one.

Physicians should accustom themselves to touching with both hands, for there are some diseases of women, and some positions of the fœtus, which compel the accoucheur to use the left hand. Or, it may also happen that a wound upon the right will necessarily require the left to be substituted, though for all ordinary purposes the right is sufficient.

The woman should be placed either in the erect, or the recumbent position during the examination, according to circumstances. In the commencement of pregnancy, it is better, as a general rule, to have her lying down; because, in this position, the head being propped up, and the inferior extremities flexed and separated, the abdominal muscles are thrown into a

state of relaxation, and thus the development of the uterus can more easily be determined. Again, such diseases as prevent the female from standing erect, may also require the same posture. But at a more advanced period, either position may be used indifferently, though most frequently the ballottement can be accomplished better while the woman is standing. In this latter case, her loins should lean against a wall or some piece of furniture; a chair must be placed at each side for her hands to rest upon, and the upper part of her body is to be slightly flexed forward.

Where any difficulties are encountered in the exploration, it is advisable to touch in both positions.

Before operating, the accoucheur should anoint his finger with some unctuous substance, fat, butter, oil, mucilage, &c., for the double object of rendering the introduction easier and less painful to the woman, and to protect himself from the contagion of any disease she may be affected with.

When the patient is recumbent, the accoucheur places himself at her side, the right one, if he intends using the right hand, and on the left, if the other is to be employed. One hand is then placed upon the abdomen, while the other is engaged in the vaginal exploration; and this precaution is especially advisable, when the ballottement is practised, in order to fix the fundus uteri, and keep it steady. In passing the finger over the perineum, and before entering the vagina, we ascertain the presence or absence of the fourchette, or the inequalities that supply its place after a labor; and as the index enters the vagina, it should examine the condition of the external labia, the length and width of the vagina, its mucous membrane, whether smooth or rugous, the various diseases, tumors, or degenerations that may exist on the surface or in the substance of its walls, and the condition of the rectum, whether full or otherwise. Hereafter, we shall have occasion to speak of this process as a means of diagnosis in the various vices of conformation.

All these explorations being made, the next step is to examine the neck of the uterus, and learn its modifications in form, consistence, situation, direction, and in the dimensions of its cavity; all which have been carefully described. (See page 130, et seq.) The finger may detect the development of the body of the uterus, by ascertaining the spreading out of its inferior part. During the first six or eight weeks of pregnancy, the changes in the uterus are practically limited to the body of the organ, which loses its nulliparous pear shape and bellies out over the cervix in all the transverse diameters, particularly antero-posteriorly, so that it resembles very much an old fashioned fat-bellied jug; at the same time the muscular substance becomes less firm, giving to the palpating finger a peculiar feeling of resiliency and compressibility. These changes, first noted by Hegar, are considered by him to be an unfailing sign of pregnancy, and his researches have been corroborated by Grandin (*N. Y. Med. Rec.*, 1886), Compes and others. The recognition of this sign requires a certain degree of expertness in bimanual palpation and familiarity with the sensation communicated to the finger by the multiparous uterus, and by the uterus pathologically altered. Owing to the normal slight ante-curvature of the uterus, it is best noted, in most cases, in the anterior cul-de-sac, where the finger, instead of following the line of the cervix in a gentle curve up on to the body, is at once conscious of a

swelling out of the body over the cervix, and on bimanual pressure the body is felt to be resilient and compressible. Until toward the third month, the organ is almost wholly within the excavation, and its mobility is very slight, in consequence of its restrained position, whilst in the ordinary unimpregnated state, it may be carried to the right or left, forward or backward, by simply pressing with the finger on the side of the neck.

2. *The Anal Examination.*—The accoucheur is very seldom obliged to introduce his finger into the rectum, but still a partial obliteration of the vagina may render such an exploration necessary; it might also be useful where there were reasons for supposing a young girl to be pregnant, who insisted upon her virginity. For the necessity of sparing the hymen, which *may possibly be intact*, renders the vaginal touch very difficult. In cases where a tumor exists at the posterior part of the vagina, it is sometimes difficult to decide whether the enlargement is located in the recto-vaginal septum, or is attached to the bony structure. Here the diagnosis is very important, for the course to be pursued in the two cases would be widely different, and all doubt may be removed at once by introducing the index into the rectum, and the thumb into the vagina.

B. *The Passive Movements, or Ballottement.*—This, according to most authors, is a sensation analogous to that produced by placing a ball of marble in a bladder full of water, and then striking the bladder with the finger just under the spot where the ball rests, when the latter is thrown up, and falls back from its own weight upon the finger which displaced it. This comparison, however, only holds good at a certain period of gestation, and we shall again take occasion to refer more particularly to this point. To perform the ballottement, M. Velpeau directs the index finger of one hand to be placed under the cervix, and the palmar face of the other hand over the fundus uteri; then, by a sudden movement of the finger in the vagina, the uterus is to be pushed upwards; being movable, free, and the only solid body in the amniotic liquid, the fœtus ascends, strikes the point diametrically opposite, and falls back upon the finger which gave it the impulse.

But as this mode will not, I believe, afford any satisfactory results in the majority of cases, I recommend students to pursue the following plan in performing the operation: the vaginal finger should *not* be placed under the cervix, because it will then be separated from the fœtus by the whole length of the neck, and of course the finger cannot recognize so clearly the descent of the displaced body; but rather in front of, or behind the neck (according to the woman's position), upon the walls of the *body itself*, for then the index is only removed from the substance to be examined by the very thin walls at the inferior region of the uterus, and it detects very readily the least motion of the inclosed fœtus.

If the woman is standing, the index should be introduced in a vertical position, with its palmar face turned forward, and the other three fingers flexed into the palm, and as the symphysis pubis scarcely exceeds an inch and a half in length, the digital extremity of the forefinger easily passes its superior part, and reaches the body of the organ, where it almost always encounters a hard globular tumor formed by the head of the fœtus; then a light, quick blow is to be given by it, after which the finger must remain

immovable on the part struck. This shock should be made in a direction from below upwards and from behind forwards, by suddenly flexing the first phalanx. This last recommendation I deem very important; for in the great majority of cases, the uterus is inclined forwards, its long diameter, like that of the fœtus, corresponding very nearly to the axis of the superior strait. Now if, under these circumstances, the shock be communicated to the presenting part of the child from below upwards, and from before backwards, as generally done, it is evident that the motion given to it will, at furthest, be but a slight movement of displacement or jolting, but never one of ascension, which in fact would be impossible, because by the direction of the blow the fœtus is pushed against the posterior uterine wall, and not along the axis of its cavity.

The ballottement may also be effected when the woman is recumbent, by acting in the manner I have just indicated, but it is then generally necessary to place the finger upon a point somewhat nearer to the neck, sometimes before, but at others behind it. The erect position, however, is usually the more favorable for the perception of the ballottement, and therefore preferable.

It sometimes happens, about the fifth month of gestation, that if the woman be standing, the vaginal touch does not afford the sensation of ballottement; but if she be directed to lie down, and the vaginal finger be applied upon the uterine wall, whilst the body of the womb is forcibly depressed by the other hand placed near the umbilicus, the vaginal finger is struck by some part or other of the fœtus, which is displaced by the external pressure.

At an early period of pregnancy, it is sometimes possible to perceive the ballottement by simply feeling the abdomen. If the woman be placed on her side, in a horizontal position, the fœtus, in obedience to gravity, descends to the lowest points. If the hand be then glided beneath the side of the abdomen which touches the bed, some part of the fœtus will be distinguished and may be readily displaced, but soon returns to its original situation.

This sign usually becomes valuable about the fourth month, for before that period the fœtus is generally too small, and, possibly, the uterine walls are too thick. Again, it varies much after that time: for instance, our search is not always successful in the fifth month, the small size of the child permitting it to change position very easily; on one day it is found without difficulty, and on the following it defies all efforts at detection.

Towards the seventh month, the ballottement is in general the most clearly recognized, since it is at this period, especially, that the finger perceives the solid mass, inclosed and swimming in a liquid, to rise up and shortly afterwards to fall back upon it; but the sensation is no longer perceptible at the end of the eighth or the beginning of the ninth month, unless there happens to be an unusual amount of water, for then the fœtus has become too large. The finger can indeed raise it, but the friction against the walls of the uterus almost destroys the tendency to ascend. The mobility of the tumor is readily detected, but it now leaves the finger which impels it; it is a displacement in mass rather than ballottement. Finally, in the latter periods of gestation, the head pushing the uterine

wall before it, engages in the superior strait, sometimes even gets low down in the excavation, thus becoming jammed in, as it were, and of course the ballottement is then altogether impossible.

Writers declare this sign to be a certain indication of pregnancy; but the proposition is, perhaps, somewhat too absolute: for example, it is possible for a stone resting in the bas-fond of the bladder to lead to an error, and I once met with a case which might readily cause a mistake of this kind. During the time I acted at the obstetrical clinic, as *chef de clinique*, a woman was subjected to the touch, who declared herself pregnant, and advanced three or four months; at first, I examined her in the recumbent position, and found all the negative signs of gestation, but one of my advanced pupils then performed the same manipulation in the standing posture, and declared that he perceived the ballottement, when I re-examined her, and found the following condition of things: The neck was strongly pushed backwards and a little to the left; it was slightly softened, and sufficiently patulous to admit the extremity of the finger. (This woman afterwards acknowledged she was delivered only four months previously.) As the finger left the cervix, and advanced just behind the symphysis pubis, it encountered a large resisting surface, which was evidently the body of the organ, and then, by giving a slight blow, a movable body was felt there, which immediately fell back upon the finger, exactly as the fœtus would in the fourth month. I confess that at first I believed her pregnant, and retouching her in the recumbent state, I once more remarked the negative signs, but my finger could not now detect the substance that had been so easily moved when she was standing. At the third examination, I discovered an anteversion of the womb, so complete that its anterior face had become inferior or horizontal, and it was over nearly the whole extent of this face the finger had passed in examining; and further, I found that the fundus uteri, situated behind the symphysis pubis, was the light movable body which had produced the sensation of ballottement.

If a similar case should occur again, it might give rise to uncertainty in diagnosis, and on that account I concluded to make it public through this work.

There are also some particular positions of the fœtus in which the ballottement would be of little service: for instance, in those of the breech it is generally very difficult, and nearly impossible in those of the trunk. In two cases, however, I succeeded in detecting a small part, which, from its diminished size, must have been an elbow, wrist, or heel; and this, together with the other signs, satisfied me that it was a position of the trunk. M. Hatin, who attended one of these women in her accouchement, found a presentation of the left shoulder; the other was delivered at the Clinique, and like the first, verified my diagnosis.

2. *Palpation of the Abdomen.*—An exploration of the abdomen, says Schmitt, is of great importance in diagnosis, and should always be resorted to when it is desirable to ascertain whether pregnancy exists. It is often, indeed, more instructive, and furnishes surer results, than the internal examination.

Some obstacles are, however, met with in this mode of research. Thus:

1, the walls of the abdomen may be too thick; 2, its muscles may be very tense; 3, the bladder may be greatly distended with urine, and the intestines with gas or fecal matter; 4, lastly, a fixed pain in the hypogastric region, rendering any pressure there often insupportable to the patient.

The too great thickness of the walls of the abdomen is the only one of these difficulties which is permanent, but which, nevertheless, frequently renders the palpation of the abdomen entirely fruitless; for as the tension and sensibility of the walls are but temporary, the exploration may be deferred to a more favorable opportunity, and the bladder and rectum may always be evacuated beforehand.

These obstacles are of rare occurrence, the examination being generally quite easy, owing to the flexibility of the walls of the abdomen.

In order to practise it, the female must lie down in such a way that her hips shall be elevated, the head flexed on the chest, and the thighs on the abdomen; in a word, so as to relax the abdominal muscles completely. Whilst in this position, the abdomen should be first examined with both hands, so as to ascertain its form, size, tension, resistance, and hardness, especially in the sub-umbilical region. In the earlier months of gestation, if the parietes are not too thick, a round tumor, of fleshy consistence, can be detected rising out of the pelvis, sometimes in the middle, and at others a little towards the right or the left side; during the first two months it seems to rise higher above the pubis than in the course of the third, which fact is readily accounted for by the sinking down of the organ, occasioned by its increasing weight and volume. This tumor, which is the womb, rises gradually toward the epigastrium as gestation progresses, and it often becomes necessary, in order to form some idea of the time at which labor will probably occur, to ascertain the exact amount of its elevation. The following is, I think, the best mode of accomplishing this object: Place the ends of the eight fingers immediately above the symphysis, and then continue to ascend gradually so long as they feel any resistance, for when the fundus uteri is gained, the resistance suddenly ceases, and the fingers sink deeper as they glide over the convexity, which is thus recognized without difficulty.

The uterine tumor, which is at first quite resisting, becomes less so as gestation advances; sometimes, however, it is so soft as to be barely distinguishable. An attentive examination will enable us to detect the following characters: 1. It always remains circumscribed and retains its oval form; 2. It presents a certain amount of elasticity, similar to that of a cyst filled with serum; 3. If this manual exploration be continued in the same direction, the examiner will detect greater or lesser parts of a single irregular mass, which are movable and easily displaced like bodies suspended in water. Often, indeed, these movable parts may be recognized as belonging to the fœtus.

As a part of the abdominal exploration should also be reckoned the sign furnished by percussion, namely, a dull sound over every part of the abdomen occupied by the developed uterus, instead of the resonance perceived at other points.

Some care is necessary in percussing, during the first four or five months

not to be misled by the dulness which a distended bladder, or a pathological tumor of considerable size might produce. It should also be borne in mind, that although the uterus may have risen to near the umbilicus, a clear sound will be yielded on percussion throughout the greater part of the sub-umbilical region, provided a few folds of intestine be interposed between the walls of the abdomen and the womb.

Sometimes the uterus is above the superior strait in the earliest months. I had an opportunity of observing a case of the kind at the Clinic, with Professor Dubois, in a woman who was advanced six weeks or two months; the uterus was so elevated, being found in the right iliac fossa, that at first we doubted the existence of pregnancy, which however was real, as was proved more positively several weeks after, and fully justified by the event of the case.

The palpation of the abdomen and the vaginal touch are in most cases practised simultaneously; we shall, therefore, point out the signs which this joint investigation furnishes at the different periods of pregnancy.

In the first three or four months the uterus either remains wholly within the lesser pelvis, or else its fundus projects somewhat above the superior strait. In the first case, it will he easily discovered by the vaginal touch that the entire excavation is occupied by a slightly movable tumor, with a smooth and regular external surface. In the second case, the lower half of the lesser pelvis is empty, but the examination of the abdomen, conducted according to the rules above mentioned, discovers the tumor formed by the womb in the hypogastrium. The first point to be ascertained is the exact size of the uterus, and this can only be determined by the double exploration spoken of: the finger having been introduced into the vagina, is applied directly on the neck, or, still better, against the anterior or posterior portion of the inferior segment of the uterus, while the other hand placed above the pubis, presses down the muscular walls, and searches for the tumor formed by the fundus uteri; the womb is thus included between the finger in the vagina and the hand on the hypogastrium, and, of course, the volume of the organ may be thus ascertained, and a comparison made between it and the unimpregnated uterus. Moreover, its displacement in mass can be very easily recognized in this position. To accomplish this, the finger should remain applied as above stated, and when the hand slightly depresses the fundus, the finger in the vagina recognizes the depression; and the counter-proof may be made by endeavoring to raise the uterus from below, by pressing strongly on the inferior part, which is found deep in the excavation.

But the tumor which is felt in the lesser pelvis, or in the hypogastric region, may be either formed by the uterus, or developed in the adjacent parts. In the latter case, the womb will generally found to be displaced, and pressed by the tumor against one of the sides of the pelvis; and if the neck be traced from below upwards, the finger will detect a line of demarcation between the wall of the uterus and the pathological tumor; sometimes, it can even be insinuated between them. The motions to which the neck is subjected are not usually communicated to the tumor, and *vice versâ*. Finally, the neck will exhibit none of the changes peculiar to pregnancy.

Hitherto we have only demonstrated that the uterus is developed, but the question arises, what is the cause of that development? The solution is nearly always difficult; we may state, however, that when the womb is enlarged by a product of conception, its walls are generally more flexible than if the enlargement were dependent upon some chronic disease; and that, after a little practice, this suppleness can be detected by carrying the finger to the posterior surface of the body, which may be done in consequence of the depression and retroversion of the fundus. The uterine wall then offers about the same resistance as an œdematous limb, or perhaps still nearer, that of caoutchouc when slightly softened in hot water.

The tumor detected either by the vaginal touch, or by depressing the ventral parietes, is rounded and smooth throughout, and does not present any of those irregularities observed in cancerous or fibrous degenerations of its walls; and this fact, together with the preceding observation, will serve to distinguish a morbid state from a true gestation.

It certainly will not prove quite so easy to determine whether the enlargement is caused by a fœtus, or the presence of a mole in the cavity; in fact, I do not believe this diagnosis is possible, except at a very advanced stage, and then the absence of the fœtal inequalities, the non-appearance of its movements, auscultation, &c., might suffice to remove the doubts on the subject.

In some women, the womb becomes congested and considerably tumefied at the menstrual periods. Now this state may readily be confounded with a commencing pregnancy, the more particularly, because at those epochs the neck usually becomes softer and dilates a little; and I know no way of escaping this error, if the woman insists that she is pregnant, and experiences the various rational signs of that condition. In two cases of the kind I have met with, I only succeeded in detecting the falsity of my diagnosis by examining the woman a second time, two or three weeks after; for these females, who were used as subjects for practising the touch at the Clinique, wished to be considered pregnant; but, unhappily for them, the fortune which aided in the first examination, deserted them at the second; for, being ignorant of the cause of my mistake, they returned at a time still more distant from their menstrual period.

On the whole, then, there is no certain sign of pregnancy during the first three or four months; yet it becomes almost certain, when the sensible signs above indicated coincide with the presence of the rational ones, in a healthy woman who can have no intention of deceiving us as to her condition; still, in a medico-legal case, the physician should express his doubts, and demand a new examination at a more advanced period. But if it is not always possible at the beginning of a gestation to prove that it does exist, we can, at least in the great majority of cases, satisfy ourselves positively that it does not; for most frequently the unimpregnated state of the organ can be readily made out.

3. *Active Movements of the Fœtus.*—The existence of pregnancy is announced during the last five months by certain signs that are far more reliable than any of those hitherto mentioned; these are the fœtal movements, which have improperly been called the *active* and *passive*, but better

designated by M. Stoltz as the movements *proper* and the *communicated* ones. We have already studied the communicated ones in treating of ballottement and palpation of the abdomen; so that it only remains to describe the active movements.

The woman generally perceives the fœtal movements at about four months and a half, although the muscles of the infant had contracted long ere this, unconsciously to her; for every accoucheur must have detected these motions by placing his hand upon the abdomen, at a time when the mother herself still doubted her own pregnancy. Now these movements are excessively feeble at first, and produce a kind of tickling, or rather a sensation analogous to that of the crawling of a spider; they gradually become more characteristic, and may then be classified in two species. One of these is produced by the movements of the whole trunk, or some of its parts, the first of which are recognized by a quivering that is perceptible to the female, while the partial motions give rise to quite large projections, which are even visible through the abdominal walls; the other, on the contrary, are blows, certain small, short strokes, which at times are violent enough to elicit cries from the sufferer, and these shocks are evidently produced by the action of the thoracic or inferior extremities of the child. Such movements, so distinct and clear to the mother, would seem to be an infallible sign of gestation, and yet such is by no means the case, since it is not at all uncommon to find women, whose veracity is beyond question, asserting that they have felt them for a long period, and sometimes the motions have even been perceived by the husband or other persons, yet without their being pregnant.

The history of one of the English queens is well known, who, believing she had felt the motions of a child, dispatched couriers with the happy news to all the foreign courts, but proved to be only the commencement of a dropsy! Such errors are frequent, and there are but few accoucheurs who have not met with many of them in practice. Consequently, the physician should not rely in this matter upon the statement of the woman, but should perceive them for himself before hazarding an opinion. It would seem, indeed, that in some cases, the intestinal movements, the rapid passage of gas in the intestines, certain partial and irregular contractions of the abdominal muscles, and the pulsation of a large artery, especially when situated behind any tumor which it raises at every beat, have often deceived not only the patient, but even her medical attendant.

Some females, from the desire of simulating pregnancy, have acquired the power of contracting their abdominal muscles in so singular a manner, that many able accoucheurs have been deceived, and believing that they felt the fœtal movements, have consequently pronounced them pregnant. (Montgomery, p. 84.)

These motions may be detected by the vaginal touch in certain positions of the breech, or even of the trunk, but we must rely chiefly on the abdominal palpation for their detection. In general, it is only necessary to place the hand flat on the abdomen, or to make use of slight pressure, to perceive them; though if they are feeble and infrequent, it is better to dip the hand in some very cold liquid, and then place it suddenly upon the skin. This rapid change in the temperature of the abdomen probably reacts upon the

infant, for it generally moves convulsively. I believe, with Dr. Tyler Smith, that the sudden impression of cold is more likely to produce a rapid contraction of the abdominal muscles or uterus, than to act directly upon the fœtus, and that its use might readily deceive as to the nature of the motions which it occasions.

I prefer placing a hand upon one of the sides of the abdomen, and striking with the other on a point opposite; for the fœtus then rarely fails to move briskly as though to resist the impulse.

As before stated, the movements begin to be felt about the end of the fourth month. To this law, however, there are numerous exceptions; thus, some women perceive them as early as the latter half of the third month, others not before the fifth, sixth, seventh, or eighth months of gestation. One woman, who had advanced to the latter period, was brought to the Clinique, in consequence of a fall in the street, and she assured us that she had never felt the movement prior to the accident. We have already alluded to the person, seen by us at La Charité, under the care of Professor Fouquier, who was delivered at term of a very healthy child, but the motions of which were neither perceptible to the mother nor ourselves.

Mauriceau, Delamotte, and many others, bring forward similar cases. But the most remarkable of all is the one reported by Campbell. I knew a lady, he says, the mother of nine children, who, excepting in her first pregnancy, never perceived any motions of the fœtus; but she was herself very inanimate and passive, and what was still more singular, the children were equally nonchalant with herself. Whenever ascites complicates the pregnancy, these motions are very indistinct, thus affording an evidence that it is the abdominal walls, and not the uterus, which perceive the impulse.

After the movements have been distinctly felt, they sometimes diminish without any appreciable cause, both in frequency and intensity, and then altogether disappear, which circumstances demand the most serious attention of the accoucheur, as it is in general an unfortunate symptom.

I believe this spontaneous cessation of the active movements may usually be referred to a congested state of the uterus, which reacts on the child's health. But whatever may be the value of this opinion, it is quite certain that bleeding, under such circumstances, has always produced a favorable result; for when not delayed too long, the movements reappear soon after, and hence I cannot recommend the measure too highly.

4. *Of Auscultation as applied to Pregnancy.*—M. Mayor, of Geneva, first detected the pulsations of the fœtal heart by auscultation; but this discovery, originally published by him in 1818, had been entirely forgotten, when M. de Kergaradec announced, in 1823, that if the abdomen of a woman who has passed the first half of her pregnancy be carefully auscultated, two sounds, which are perfectly distinct in character, will be recognized: one of them, consisting of double pulsations, or rather of redoubled ones, according to the expression of M. Stoltz, is evidently produced by the movements of the fœtal heart, and has been compared, with some reason, to the ticking of a watch enveloped in a napkin; the other is a kind of rustling, unattended by shocks, and consequently without beating, being

characterized by simple pulsations, accompanied by the souffle, which have been successively compared to the sibilant murmur, or to the sound of an erectile tumor, or varicose aneurism; this is called the bellows sound (*bruit de souffle*). Another bellows murmur, of more frequent occurrence than the former, is termed the *murmur of the cord*, and will be studied after the preceding.[1]

[At the end of the third month the pulsations of the fœtal heart may, therefore, be heard, though not as a general rule. Careful and long continued auscultation at this period, however, often enables us to detect with the stethoscope sudden and repeated blows, which would seem to be produced by rapid motions of the fœtus. The sensation is sometimes so clear, and leaves so little doubt as to its cause, that the sound occasioned by the displacement of the fœtus in the amniotic fluid may be accepted as a useful sign in the diagnosis of pregnancy, and one which, in a difficult case, ought not to be neglected. It cannot, however, be always detected, inasmuch as it is necessary that the fœtus should move briskly at the moment of observation.]

1. *Sound of the Heart.*—The pulsations of the heart generally become perceptible in the course of the fourth or fifth month, though more frequently during the latter, and often then at an elevated part of the abdomen near the umbilical region; in one case, however, I thought I heard them a little before the fourth month, but, unfortunately, I could not re-examine the female until six weeks afterwards. M. Depaul declares that he has heard them at the end of the third month and in the eleventh week.

These pulsations are far more frequent than those of the mother's heart; ranging, as they do, from one hundred and thirty to one hundred and sixty per minute; and, moreover, they are very often accelerated or diminished, without our being able to detect the cause of the changes.

Like most observers, I have several times remarked that, if the fœtus exhibited any violent movements during the examination, the pulsation increased and became very difficult to count; but they are not influenced by any variations in the mother's pulse, whatever may be their cause.

The dorsal region of the child seems to transmit the double pulsations most easily, and consequently they are more clearly perceived at that part of the abdomen which corresponds to it. This circumstance likewise explains why the pulsations change position so easily prior to the seventh month; in fact, it is only during the last three months, that extensive movements on the part of the child become difficult, and its position nearly fixed.

They may be heard most frequently on the anterior inferior portion of the abdominal wall, just above the iliac fossa, or still more rarely on the median line, and not merely at a very limited spot, but over a radius of two or three inches. In some cases they may even be heard over more than half of the abdomen; but it is always easy to perceive that they are stronger

[1] The character of this work prevents our giving a detailed account of the history of this important subject. I cannot, however, too strongly recommend all who wish to be fully informed upon the matter, to consult the excellent Monograph recently published by M. Depaul. (*Traité de l'Auscultation Obstetricale*, 1847.)

and clearer at one point than elsewhere, and from this point as a centre, they become weaker and weaker as the distance increases. The intensity of pulsation is of course less marked as the child is younger, although, in some instances, they exhibit as much force in the sixth month as at term, but this is very unusual.

As regards the number of pulsations, the statement made by many observers that it is much more considerable at an earlier period than at term, is not absolutely true, for the fœtal heart always beats with the same quickness, saving some accidental variations, at whatever period it may be examined. Labor produces no modification of the fœtal pulsations up to the moment of rupturing the membranes; but this rule fails after the amniotic liquid has escaped, because they are then generally louder and clearer, and may be heard over a more considerable extent of surface, which can readily be explained by the fact that the ear or instrument is then nearer the fœtus.

When the contractions become more energetic, the pulsations are not so regular, and they are more feeble and slower while the contraction lasts.

In those cases where the labor is of moderate duration, the indistinctness of the sound of the heart may be referred, I believe, to the difficulty of ausculting during the pain; but if the fœtus has been too long subjected to uterine pressure—as where the labor has been unusually prolonged—the number, force, and regularity of the pulsations sensibly decrease

Most observers have asserted that the sounds are not always perceptible, and M. Stoltz even declares that they cannot be heard whenever the dorsal region is directed backwards, unless some part of the thorax be in contact with a portion of the uterine walls which may be explored. For my own part, I have not failed, for several years past, to hear them in examinations made after the sixth month, in all cases where the children were living; and as my researches have now extended to at least seven or eight hundred women, I feel convinced that we can always distinguish them after that period, in any position of the fœtus whatever.

M. Dubois was the first to point out the fact, that the sound of the fœtal heart has sometimes a peculiar resonance, resembling the metallic tinkling, a singularity which I have twice had the opportunity of observing at the Clinique. This remarkable sonoriety is most frequently met with in women in whom the uterus is distended by a great quantity of fluid. There are also some circumstances which render the pulsation a little obscure and somewhat difficult to hear; thus, for instance, a lumbo-posterior position of the fœtus, a large quantity of water, by which the uterine walls are greatly distended, and a sufficient depression of them by the stethoscope to approach the child prevented; the interposition of several folds of intestines between the abdominal walls and the uterus, and the existence of borborygmi, are all so many circumstances calculated to render the perception of the pulsations more difficult, although not absolutely impossible.

The beatings of the fœtal heart are composed of two distinct sounds, the second being stronger and more sonorous than the first; but, in a great majority of cases, both of them may be heard quite distinctly.

M. Nægèle, however, appears to think that only a single sound is heard

under certain circumstances, and I have sometimes made the same observation; but it has always seemed to me that the perception of only one sound might either be referred to bad manipulation on my part, or else to some one of those circumstances just described having prevented the application of the stethoscope over a point near enough to the back of the fœtus. Thus, though I have frequently heard but a single sound at first, after changing the instrument, others became clearly perceptible. I am happy to extract the following paragraph from the thesis of M. Carrière, a pupil of M. Stoltz, which fully confirms my opinion. He says: "I have remarked that the single character of the fœtal pulsations here described, is most likely to be observed when the point examined approaches the fundus of the uterus."

Like all useful discoveries, obstetrical auscultation has had its opponents as well as its partisans; and though the former are daily diminishing in number, the latter certainly have injured their cause by exaggerating its importance; we shall, however, carefully endeavor to ascertain its practical utility.

a. It has been stated that a perception of the pulsations of the fœtal heart was a certain sign of pregnancy, as also that the absence of this sound, positively determined by several examinations made after intervals of some hours, subsequent to the sixth month, announces with certainty the death of the fœtus; supposing, of course, we have a satisfactory assurance of the previous existence of gestation.

[It is a very rare circumstance, says M. Depaul, for the pulsations of the fœtal heart to be inaudible during the three last months of gestation, unless the child be dead. They failed to be detected in but eight cases out of nine hundred and six, examined at this period.]

There is, notwithstanding, one circumstance which might lead to a suspicion of pregnancy even when the uterus was really empty; it is this: in certain females the pulsation of the heart is felt and heard as low down as the sub-umbilical region, and we can imagine that if, in such persons, under the emotions naturally produced by an unjust suspicion of gestation, or, from the influence of any febrile movement, the circulation be accelerated, the pulsations, from their number and rapidity, might be mistaken for those of a fœtus; but in such cases, all errors of diagnosis may be easily avoided by observing: 1st. The perfect isochronism between the pulse at the wrist and the abdominal beatings; and 2d. That the intensity of pulsation constantly increases as the precordial region is approached; which two peculiarities are never presented by the sound of the fœtal heart.

b. Can a twin pregnancy always be recognized by auscultation? It is said that, in most cases, the existence of two children in the uterine cavity may be known by the following sounds: 1st. The sound of the heart will be heard at two distant parts of the abdomen; and 2d. The want of isochronism, and of frequency, which may sometimes be detected between these two series of pulsations.

These characters are advanced by some writers as indicating a double pregnancy with certainty, but we shall point out several sources of error on this point: thus, it frequently happens that the pulsations of a single heart resound in very distant parts. Now, can this be referred, as M Dubois

thinks, to deficient thoracic development, to the unusual comparative size of the heart's cavities, to the density of the lungs, or, lastly, to the position of the fœtus itself, the head and extremities of which, being applied against the thorax, and there receiving the impulses from the heart's contractions, serve to transmit them to a greater distance? I should be inclined to adopt this view; for, whatever be the explanation, the fact is certain, and the following appears to me the best method of resolving the difficulty: Whenever the pulsations are heard at two distant points, the line between these should be carefully followed with the instrument; for if they are produced by the presence of two fœtuses, the pulsations will become feeble, or almost disappear, towards the centre of this line; but if, on the contrary, they are due to a single child, they will be just as strong at its middle part as at either extremity.

Again, the absence of isochronism in the pulsation does not positively prove the existence of two children; for one series may be owing to the fœtal heart, and the other belong to the same organ in the mother, the resonance being transmitted to the abdominal cavity. Hence, it is evident that the unusual distinctness of the mother's pulsations coinciding with the presence of a single fœtus may lead to the belief of a double pregnancy which does not exist, and a comparative examination of the pulse then becomes necessary.

[After all, it must be acknowledged that the pulsations of the fœtal heart may vary from one instant to another, without our being able to comprehend why such should be the case. It may lead, also, to a wrong inference when the auscultation is practised at two different points successively, inasmuch as a want of isochronism might in this case give rise to the impression that there were two children, whilst, in fact, there was heard the sound of but a single heart beating with variable rapidity. To avoid all chance of error, two practised observers should place their stethoscopes over the two points where the sounds are most clearly heard, and then count them together during the same time. Should there be a notable difference between the two numbers thus obtained, a twin pregnancy may be regarded as certain.]

A double gestation may be easily recognized, if the precautions just indicated are observed, because, the twins being habitually placed one on the right the other at the left part of the abdomen, distinct beatings will be clearly heard, if the stethoscope be successively applied to each side. But this happy state of affairs does not always exist, for sometimes one fœtus is situated directly before the other; and then it is nearly impossible, even with the greatest attention, to hear the heart of the posterior child; and, consequently, when the other signs of a twin pregnancy are present, the results derived from auscultation would not prove its non-existence. Is it necessary to add, that equal care should be taken to abstain from hasty decisions in those cases in which there is reason to believe that one of the children is dead?

c. Can we appreciate the state of the child's health or disease, of its debility or vigor, during labor, by means of auscultation?

This question, which was brought before the Academy by a memoir of M. Bodson, and which gave rise to a remarkable report by M. P. Dubois,

is certainly one of the most curious and interesting subjects of study; for if we could possibly judge from the signs furnished by auscultation, of the integrity of the fœtal life, no uncertainty could arise with regard to the course to be pursued when the labor is too long delayed, after the rupture of the membranes; for the feebleness and relaxation, or the excessive frequency of the fœtal pulsations; the intermission and irregularity of their rhythm; the absence of the second stroke; or the complete cessation of this phenomenon during the uterine contraction, and the slowness of its return after the pain has ceased, would sufficiently authorize a prompt termination; whilst the opposite phenomena would justify delay.

These signs, and more especially the irregularity of the pulsations, which appears the most important of all, indicate in the clearest manner that the fœtus is in a state of suffering; and hence they should serve as a formal indication to the accoucheur to remove the infant promptly from the danger which threatens it, by an artificial termination of the labor. But, as M. Dubois has very judiciously remarked, there is not then a sufficient integrity of circulation to establish the extra uterine life; for, although the fœtal pulsations may be still regular and sonorous at the moment of birth, yet the child has suffered so much from the long pressure of labor, that the respiration cannot be established; and hence, in this respect, the accoucheur should not rely upon auscultation alone for judging of the opportune moment for the intervention of art, because other considerations quite as important should influence his decision; still, however, this is a method of diagnosis that is never to be neglected.

2. *Souffle of the Cord.*—M. Nægèle, junior, has recently described a bellows murmur, which he attributes to the pulsations of the umbilical cord, and compares it with the sound produced by the beating of the carotids in chlorosis, and the murmur consists, he states, of a simple pulsation which is caused, as he thinks, by the winding of the cord around the neck of the fœtus, or by its compression between the child's back and the uterine walls; the sound increases after the escape of the liquor amnii, and its force is greater in proportion as the arteries of the cord are the more developed, and subjected to greater tension.

In the positions of the head, it is situated below the umbilicus, but higher up in those of the breech, and it seems to descend during the expulsion of the fœtus. Sometimes a bellows murmur is heard accompanying the cardiac pulsations, especially at the first sound, but it appears difficult to reconcile this circumstance with the interruption in the circulation caused by any pressure on the cord. Since M. Nægèle, junior, pointed out this peculiarity, several others have noticed it, and I also have met with it at different times, where nothing would indicate even a slight compression of the cord, or any winding around the neck.

Does this belong to the fœtal heart, as M. Dubois and M. Depaul believe? Indeed, the latter states that he has detected this sound, which he had previously heard during the intra-uterine life, by ausculting the infant immediately after birth. But nine other cases, he says, turned out differently, and oblige me to state the facts as they occurred. The fœtal murmur occupied a part of the uterus entirely removed from that where the beating

of the heart was detected; the latter being pure, and unmixed with any murmur. Five of these children were born with one or several turns of the cord about the neck, whilst in the sixth, it surrounded the lower part of the thorax. The remaining three were free from anything of the kind. All were born living, and on none of them was it possible to detect a souffle in the cardiac region immediately after birth.

The question must therefore be decided by new observations; for, although the sound may be produced by the compression of the cord, the compression often exists without the abnormal murmur.

3. *Uterine Souffle.*—Numerous denominations, each of which is founded on its supposed nature, have been applied to this sound; for instance, M. Kergaradec thought it was produced in the utero-placental circulation, and hence gave it the name of the *placental murmur;* on the other hand, M. Bouillaud, and many others, have subsequently assigned its seat (which, to say the least, is very probable) to the large arterial trunks placed on the posterior abdominal plane, where they are subjected to considerable pressure from the developed uterus, and they have denominated it on this account the *abdominal souffle;* and still more recently, M. Paul Dubois has endeavored to prove that it originates in the vessels which ramify in the substance of the uterine wall itself, whence he has called it the *uterine souffle.* But as we shall take occasion hereafter to discuss these three opinions, which embrace all our present knowledge on the subject, we will pass them over here.

In general, the bellows murmur may be heard as soon as the uterus, by rising above the superior strait, becomes accessible to the stethoscope—that is, a little earlier than the sound of the fœtal heart; in fact, M. Delens asserts he has detected it at the third month, and Dr. Kennedy towards the tenth, eleventh, or the twelfth week. M. Depaul has also made the same observation; but as there is a very great difficulty in approaching the uterus at so early a period, these facts are certainly exceptional.

The murmur undergoes some very singular modifications during the course of pregnancy: thus, we do not hear it in every instance; again, it is not at all unusual for it to escape detection for a long time after having once been heard, and then to reappear somewhat later; sometimes even we may auscult for several minutes in vain, when it suddenly appears directly under the ear, augments, becomes quite loud and distinct, lasts for a few moments, then diminishes, and finally ceases altogether.

In other cases, two or three pulsations, attended by *blowing*, are heard during profound silence, but nothing more after that; and on the other hand, very frequent opportunities are afforded us of observing the promptitude with which the sound changes its locality; for it seems to pass suddenly from one point to an opposite one, being sometimes immediately beneath the ear, at others very distant: only covering a single spot in the majority of cases, but occasionally extending to two remote regions, and, what is very remarkable, with equal force and clearness at both these points; further, the extent over which the sound is heard is usually quite limited, but in some instances it becomes perceptible over a very large surface, trespassing upon nearly the whole anterior abdominal region.

On several occasions my pupils have had opportunities of studying all

these varieties, which indeed are almost inexplicable, whatever opinion may be adopted as to the cause of the sound.

The murmur is modified during labor; for at the very instant when the pains begin, and even before the patient herself is aware of them, it becomes at once louder, more sonorous, and more distinct, and at times exhibits some strange modifications: thus, at one time the sound heard resembles, partially at least, the tone of a reed, or a tense cord thrown into vibration, though as soon as the contraction becomes stronger and more general, it seems to grow weaker, appearing at longer intervals, and finally becoming imperceptible; but when the pain ceases, the sound returns, at first with the intensity it manifested at the beginning of the contraction, and gradually regains the same sonorousness it had during the gestation. Such is the order presented when the contractions are regular and energetic; but if they are false or irregular, the souffle is not modified, or at least is not any stronger, except it be for a few instants only.

It may likewise be perceived after the expulsion of the fœtus, and even of the after-birth: for example, M. Carrière says he heard it twenty-four hours subsequent to the delivery of the placenta.

Generally, it extends towards the inferior lateral part of the abdomen; more rarely, it is heard near the fundus uteri.

The following is the result of 295 observations, made by M. Depaul, of women who had passed the fifth month of gestation; it will be seen that it accords with my own experience. It was heard very distinctly 182 times on each side of the uterus, at a short distance from the crural arch; in 27 cases, it appeared on one side only; in 43, towards the fundus of the organ; and in 18, it was spread over the entire surface of the uterus. Finally, M. Depaul states, that in 12 cases, it was present in three distinct situations, namely, the fundus of the womb and the parts above the crural arches. During the first half of the pregnancy, it was oftenest observed when the stethoscope was placed upon the median line a little above the pubis.

The character of the sound heard varies greatly; sometimes it is short, abrupt, and separated from the succeeding one by a longer or shorter interval of complete silence, which is dependent upon the frequency of the pulse; sometimes it is a prolonged roaring, a true "bruit de diable," which has its period of beginning, of increase, and termination, the latter blending with the next succession.

In short, it presents all the variations of rhythm which have been attributed to the chlorotic murmurs. Though generally simple and intermittent, it is sometimes continuous and double (bruit de diable); finally, it may be both continuous and simple. I have not yet met with the typical, double intermittent sound. Like the murmur in the carotids, the rhythm may change in a few moments so as to present in a very short time several of the varieties just mentioned.

The quality of the sound also varies greatly; and this not only in different women, but even in the same woman, and sometimes whilst the exploration is going on. Occasionally it is whistling, and resembles much the sound of the wind blowing through a badly closed doorway; again it becomes roaring, so as to imitate the vibrations of a base cord; at other times it is plaintive, suggesting the cooings of a turtle-dove.

The seat and mode of production of this sound is a question that has given rise to much controversy, though, as the sound is synchronous with the mother's pulse, it must be evidently connected with the maternal vascular system. Thus far all agree, but diversities of opinion immediately spring up when a more precise location of it is attempted; for the murmur is produced outside of the uterus, exclaims one party; not so, it is seated in the uterine or the placental vessels, say the others.

1. *The Murmur is produced in Parts distinct from the Uterus.*—Whenever a tumor is developed over the course of a large arterial trunk, the compression exercised by it on the vessel produces a souffle, and it is not at all unusual, whenever a pathological tumor is developed in the abdomen, to hear a murmur in such cases, very nearly resembling that of pregnancy; now, the uterus developed by a product of conception constitutes a considerable tumor, one which must necessarily compress the vessels and produce the effect described. This view is advocated by numerous partisans, who contend that the murmur does not begin to appear until the uterus really compresses the iliac vessels by being elevated above the superior strait; that it is usually heard at the inferior lateral part of the abdomen, and more frequently on the right side, because the uterus is habitually inclined to the right; and lastly, that if, according to the plan of my friend, Dr. Jacquemier (which I have since often practised myself), the female, after having been ausculted in the supine position, be made to kneel down, with the body bent forward nearly horizontally, and the elbows resting on the ground, in a word, in such a position as to throw the whole weight of the uterus upon the anterior abdominal wall, the murmur will no longer be heard, although distinctly audible before.

In support of this opinion the following considerations may be adduced:

The abdominal souffle is, like that of chlorosis, partly due to the alterations which the blood undergoes during pregnancy. Whatever theory be embraced respecting the mechanism of these abnormal vascular sounds in chlorosis, whether they be attributed to the diminution of the corpuscles, as M. Andral supposes, or to hydræmia, according to M. Beau, and, we may add in passing, this latter theory seems to me to be the only admissible one, the great analogy between the blood of chlorosis and that of pregnancy cannot be ignored.

It is equally difficult not to recognize the entire resemblance between the souffle of pregnant women and that of chlorotic patients. They exhibit the same varieties of rhythm, as also of tone and sonorousness; both are sometimes mixed or composed simply of buzzing, rasping, or whistling sounds, which seem to be alike peculiar to the early stages of the affection. Both present, if I may so express it, the same mobility of duration, rhythm, and intensity, and appear to be similarly affected by the greater or less pressure of the instrument, as also by changes in the circulation of the female as a consequence of disturbances of temper, violent movements, &c.

Is it not, therefore, natural to conclude, that since pregnancy and chlorosis produce the same changes in the blood, the souffle, which is exactly alike in both cases, is also due to the same cause?

But, it will be replied, in chlorosis the murmur is heard more especially

in the cervical region; why, therefore, during pregnancy should it, if due to the same cause, fix itself particularly in the abdomen? I would reply, in the first place, that in some cases the cardiac and carotid murmurs have been observed in pregnant women; still I admit that, most generally, they are not heard even when the abdominal souffle is present. The latter circumstance can be readily explained, for it is in fact rarely that the alteration of the blood is carried to the same extent as in ordinary chlorosis; the proportion of globules rarely descends below one hundred, and the amount of water is far from equalling the enormous proportion which it reaches in chlorosis. Now, if it be true, as M. Andral supposes, that the production of abnormal sounds is an indication of a more advanced alteration, we can comprehend why they should not be perceptible in the carotids, where only poverty of the blood could produce them.

The conditions are not the same in the abdominal vessels, for there, to a commencing hydræmia, is superadded a considerable diminution of the calibre of the vessels, which diminution is a result of the compression of the uterine tumor; and these two circumstances united are capable of producing a souffle which they would be unable to determine singly. The compression of the arteries thus gives rise to a sort of insufficiency, which renders still more sensible the slight increase which the total amount of the blood has undergone.

It has been stated that we have several times known the sound to disappear when the woman was placed on all fours, but that in other instances it still remained. M. Depaul recollects having repeated this experiment, with the effect of continuing to hear the uterine murmur, without the slightest variation. This last remark, made by such observers as MM. Depaul and Carrière, deserves further attention on our part. As M. Beau has pointed out, it is much more difficult than would be supposed, and sometimes even impossible, to cause the woman to assume such a position that the large arteries shall escape all compression by the uterus. The abdominal walls of young primiparous women are too resisting to yield under the momentary weight of the uterus, and whatever position be assumed, they retain the organ strongly applied against the posterior plane of the abdomen.

M. Beau has also proved that this persistence of the abdominal souffle is not peculiar to pregnancy, but that in the case of a woman affected with a cyst of the ovary, shown to be such at the autopsy, it was impossible to give the tumor any position in which it ceased to compress the arteries of the pelvis, and consequently to put an end to the murmur.

I would add, that, whilst admitting that compression is not the sole cause of the murmur, but that the serous plethora of pregnancy also contributes to its production, it might be readily supposed that if the latter reach a certain degree, it might of itself give rise to the abnormal sound, even should the position of the female entirely relieve the abdominal vessels from pressure.

The same remarks will apply to the variable results which are sometimes obtained, when, after having heard the sounds on one side of the abdomen, the woman is made to reverse her position. Sometimes, we have

said, it ceases to be heard; at others it persists, although the inclination of the uterus had removed the pressure from the vessels on the point opposite the side upon which the woman lies. In the first case, the plethora was too slight to maintain a sound, the production of which was partly due to the compression of the vascular tube; in the second, either the inclination of the uterus had not removed the pressure, or else the alteration of the blood was alone sufficient to produce the abnormal sound.

Although MM. Barth and Roger are disposed to attribute the abdominal murmur to pressure, they nevertheless find some objections which prevent their adopting the opinion in its full extent. Why, say they, is not the sound increased when the uterus is pressed upon with the stethoscope, and why does it sometimes disappear when the pressure is made rather stronger? It is, replies M. Beau, because the murmurs are the result of a certain degree of pressure, which if increased or diminished, the sounds are altered or lessened. The effect is the same as that which is frequently observed in the carotid murmurs, which do not increase, and which even disappear, when too much pressure is made upon the artery; and as these latter sounds are sometimes found to have their intensity somewhat increased by a slight pressure, so the abdominal murmurs are occasionally notably increased when the uterus is a little pressed upon.

Finally, how happens it, say MM. Barth and Roger, that in certain cases in which no souffle was heard upon auscultation of the abdomen, it could, through the assistance of the metroscope of M. Nauche, be perceived upon the neck of the uterus, which is situated in the centre of the pelvic cavity, and therefore removed from the vessels?

We may suppose, again replies M. Beau, that in the cases in question the murmur had its origin in the hypogastric arteries. Now the neck of the uterus is nearer these arteries, than that part of the body of the organ which is in relation with the abdominal parietes. Besides, it is not possible that certain organs which are poor conductors of sound, such as a mass of intestine or of omentum, might have been interposed between the surface of the uterus and the walls of the abdomen, and thus have prevented the transmission of the vibrations to the ear?

2. *The Murmur is produced in the Uterus.*—Those who locate the sound in the uterine circulation, differ essentially as to its precise seat and the mode of its production. Thus, M. de Kergaradec attributes it to the placental circulation; whilst M. Hohl, who also believes it is perceived at the point where the placenta is inserted, locates the murmur at a point corresponding to the insertion of the placenta, and bases his opinion upon the following reasons: 1. In 21 cases in which he removed the placenta with his hand, he found it adhering where the souffle was first heard; 2. In 15 cases where it was inserted upon the orifice, the murmur was heard very low down; 3. In 10 others the autopsy revealed the after-birth where the souffle had been distinguished; 4. In 8 cases of version the same fact was discovered directly; 5. In 12 cases of twin pregnancy, one murmur only was heard when but a single placenta was present, and two distinct ones when the after-births were separate; 6. Lastly, in a great number of cases the intensity of the sound appeared to be in direct relation with the bulk and extent of the placenta.

M. Hohl differs from M. Kergaradec by supposing that the sound results from the passage of the arterial blood into the venous sinuses of the placenta; but, to refute this latter opinion, it is only necessary to bear in mind the great variety in the seat of the murmur during pregnancy, and that in some cases it is still perceptible after the delivery of the after-birth.

I am therefore, like M. Depaul, convinced, that there is no relation between the point where the souffle is heard and that of the insertion of the placenta

The views of M. Dubois still claim a notice; for whenever, says this Professor, the disposition of the uterine apparatus is carefully studied, the freest communication will be found to exist between the arteries and veins, the uterine walls appearing to be transformed into an erectile tissue, or one of varicose aneurisms; and the column of blood brought by the arteries, and divided through their branches, mingles, whilst passing directly into the veins, with the slower and less compressed columns contained in the canals of the latter. This circumstance is incontestably the cause of the murmur and souffle that is so remarkable in varicose aneurisms and the accidental erectile tissues, and it is very likely that the same cause produces it in the uterine walls. Hence we can comprehend why it is only heard at that period when the vascular modifications of the organ are the most marked; why it is most frequently audible over the spot corresponding to the placental insertion, because the development of the uterine vascular system is the most considerable there; and finally, why this sound may still be heard in some women after delivery, when the retreat of the uterus is not yet complete, and the circulation in its walls has not been reduced to its condition in the non-gravid state.

No one, since the researches of M. Dubois, has been able to rediscover the large and free communications between the uterine arteries and veins; it is in fact certain, that they communicate directly in no other way than through their terminal and capillary ramifications. It is plain, that when a supposed anatomical fact is proved to have no existence, the theory which is founded upon it can no longer be maintained.

There are still some other points concerning the uterine circulation, which have recently been advanced: thus, Dr. Corrigan thought the passage of the blood from the uterine arteries into the sinuses, was the cause of the souffle; and M. Carrière, who admitted this opinion, added, that the circulation being much more active at the point corresponding to the placental insertion, the sound should be most audible on a level with that insertion.

M. Depaul has quite recently repromulgated the views of Corrigan, adding thereto the compressions produced both within and without by some portion of the fœtal ovoid, and he attributes an important influence to these compressions, which, however, had previously been brought forward by M. de Kergaradec, in explanation of the frequent variations of the souffle in its seat and intensity.

The cause of the sound, says M. de la Harpe de Lausanne, neither rests on a particular condition of the blood, nor on a modification of its course, nor yet in any peculiar state of the vessels, but simply on the multiplicity of the vessels concentrating at the same point; which multiplicity, by

increasing the currents a hundredfold, increases the sounds in the same ratio; thus rendering those audible by multiplication, which, taken singly, were imperceptible to the human ear. Perhaps a comparison will serve to illustrate this idea: if a person place himself, on a mild day, under a tree that has been closely pruned, deprived of its leaves, and only having some large branches left, he will hear no sound or rustling of the air; now let him pass from this tree to another one better furnished with branches, though still deprived of leaves, and he will perceive, if the same air be stirring, a commencing sound, produced by the branches that are agitated in the wind; again, the intensity of sound will become much greater, if he once more changes to a fir-tree; for notwithstanding the leaves of this latter are rigid and immovable, yet they are innumerable; and just such is the case with the placental murmur. In fact, a liquid cannot circulate in a tube without producing a certain amount of sound by the friction of its molecules against the walls of the tube; only the sound is not detected by the ear when the vascular canal is isolated, but the contrary results, when thousands of little canals are found at the same point.

[Amidst so many contradictory theories we shall not undertake to decide upon the mechanical production of the bellows murmur, but will endeavor to determine the seat of the sound, premising, however, that we do not believe that it is produced in the great blood-vessels which are situated behind the uterus. The sound is sometimes really so superficial that it cannot be produced in the aorta or the iliac vessels; how, besides, will this explanation enable us to understand the facility with which it changes place, a circumstance to which all observers can testify? Finally, we would add that, in some very rare cases, the sound is accompanied by a thrill, which is easily perceived by the finger, and felt, so to speak, to be produced behind the anterior wall of the abdomen. We regard it, therefore, as certain that it is produced in the uterus, and as we have already shown that it cannot have its origin in the placenta, we agree with MM. Dubois and Depaul, that it is located in the walls of the uterus. It is evident, therefore, that the term uterine souffle is the only one which can be properly applied to it.]

The abdominal souffle is not of great practical importance; its value, as a sign, is limited to rendering the existence of pregnancy probable. It may exist independently of pregnancy, and does not always accompany it; it is not influenced by the life or death of the fœtus, nor is it modified in any degree by a state of suffering of the child; it cannot, in any case, enable us to determine certainly either the place of insertion of the placenta, nor its form, size, or the changes which it may undergo. The observations of MM. Depaul and Nægèle, Jr., prove, in opposition to the conclusions of Hohl, that the diagnosis of double or triple pregnancies, is incapable of assistance from the souffle, presenting as it does in these cases no modifications which are not also observed in simple pregnancies.

Summary.—It is now well understood that, in ausculting the abdomen of a pregnant woman, we may hear both the pulsations of the fœtal heart and the bruit de souffle. The first is a certain sign of pregnancy; but the second, being also produced by other causes, only becomes of importance when we have previously ascertained that the female has no other disease.

The sound of the heart may aid in ascertaining the position of the fœtus; the souffle can communicate no information as to the place of insertion of

the placenta, and indicates nothing as regards the child's position; while any feebleness, and more especially any irregularity or intermittence of the heart's pulsations, furnish strong presumptive reasons for believing that the fœtus is suffering, and that its life is compromised.

When desirable to auscult a female who is supposed to be pregnant, we must request her to lie down on her back; at the commencement of gestation this precaution is indispensable; but towards the last it becomes less so, and she may then be examined standing. In fact, whatever be her position in the latter months, this exploration is quite easy, on account of the dimensions of the uterus and the volume of the fœtus, but at first it is nearly always necessary to flex the thighs upon the belly, so as to completely relax the abdominal muscles, and of course this could only be done in the horizontal position. The dorsal or lateral decubitus is requisite to explore thoroughly the fundus or sides of the womb, and also to cause the fœtus to fall from either side; the thighs should also be flexed, or extended, according to the region examined. The unaided ear will answer, but the stethoscope should generally be employed; for, by using it, the sounds detected can be more readily limited, and the abdominal parietes more easily depressed so as to approach nearer to the fœtus; besides, many females object to the accoucheur thus applying his head flat on the abdomen. Experience has likewise convinced me that, when the unassisted ear is used, the clearness of the sensations is singularly diminished by the frictions which the respiratory movements of the abdomen make against the ear. When used, the enlarged extremity of the instrument should be deprived of its mouth-piece, and its whole circumference be exactly placed over the region to be ausculted.

It is also advisable that the woman lie on a bed of sufficient height, otherwise the accoucheur is obliged to stoop too much, and this inconvenient position is attended by such a degree of congestion as to render it impossible to hear anything. And further, to avoid all unnecessary searching, it is best to place the stethoscope at first directly over the part where the pulsations of the heart are most commonly heard, that is, in front, below, and a little to the left side.

It is equally desirable to ascertain from the female where she generally perceives the fœtal movements, for most frequently the pulsations of the heart will be found on the opposite side, because the superior and inferior extremities being always folded on the abdominal plane, the back, in other words, the part of the fœtus which most easily transmits the sounds, will evidently be turned towards the left, if the right side is the habitual seat of the active motions.

Before the fifth month, the pulsations are usually perceived in the lower part of the abdomen on the median line, about half-way between the pubis and umbilicus; consequently the instrument should be first applied there.

The instrument proposed by Nauche, under the name of metroscope, the extremity of which is intended to be introduced into the vagina and applied to the neck or inferior part of the womb, ought not to be used.

A Table exhibiting the Signs of Pregnancy at various Periods.

RATIONAL SIGNS.	SENSIBLE SIGNS.
First and Second Months.	
1. Suppression of the menses (numerous exceptions).	1. Augmentation in the size and weight of the uterus.
2. Nausea — vomiting.	2. Descent of the organ.
3. Slight flatness of the hypogastric region.	3. The womb is less movable.
4. Depression of the umbilical ring.	4. Its walls have the consistence of caoutchouc.
5. Tumefaction of the breasts, accompanied with sensations of pricking and tenderness.	5. The neck is directed downwards, forwards, and to the left.
	6. The body becomes more globular and feels elastic to bimanual palpation.
	7. The orifice of the os tincæ is rounded in primiparæ, but more patulous in others who have had children.
	8. A slight softening of the mucous membrane covering the lips, and this membrane appears œdematous.
Third and Fourth Months.	
1. Suppression of the menses (a few exceptions).	1. The fundus uteri rises to the level of the superior strait towards the end of the third month, and is perceived at the close of the fourth about the middle of the space between the umbilicus and pubis.
2. Frequently, the appearance or the continuance of the vomitings.	2. A perceptible flatness on percussion in the hypogastric region.
3. A small protuberance in the hypogastric region.	3. A rounded tumor, as large as a child's head of a year old, may be detected by the abdominal palpation.
4. Less depression of the umbilical cicatrix.	4. By resorting to this process and the vaginal touch jointly, the displacement en masse, and the volume of the uterus may easily be ascertained.
5. Augmented swelling of the breasts, prominence of the nipple, and slight discoloration in the areola.	5. The neck has the same situation and direction during the third month as in the preceding ones; at the fourth it is elevated and directed backwards and to the left side.
6. Kyesteine in the urine.	6. The softening of the periphery of the orifice is much better marked. The latter is more open in *multiparæ*, even admitting the extremity of the finger; but is closed and always rounded in primiparæ.
Fifth and Sixth Months.	
1. Suppression of the menses (some rare exceptions).	1. The fundus uteri is one finger's breadth below the umbilicus at the end of the fifth month; and the same distance above it at the expiration of the sixth.
2. The disturbances in the digestive organs generally disappear.	2. Fœtal irregularities, and active movements, which are very perceptible.
3. Considerable development of the whole sub-umbilical region.	3. The sound of the heart and abdominal souffle are now perceptible.

RATIONAL SIGNS.	SENSIBLE SIGNS.
4. A convex, fluctuating, rounded abdominal tumor, salient, particularly on the middle line, and sometimes exhibiting the fœtal inequalities.	4. Ballottement.
5. The umbilical depression is almost completely effaced.	5. A tumor is felt at the anterior superior part of the vagina, which is sometimes soft and fluctuating, at others rounded, hard, and resisting.
6. The discoloration in the areola is deeper; glandiform tubercles; areola spotted.	6. The inferior half of the intra-vaginal portion of the cervix uteri is softened
7. Kvesteine in the urine.	7. The whole ungual part of the first phalangeal bone can penetrate the cavity of the neck in *multiparæ*. The latter is softened to the same extent in primiparæ, but the orifice is closed.

Seventh and Eighth Months.

1. Suppression of the menses (the exceptions are very rare).	1. Increased size of the abdomen.
2. Disorders of the stomach (rather rare).	2. The fundus uteri is four fingers' breadth above the umbilicus at the seventh month, and five or six at the eighth.
3. The abdominal tumor has the same characters, except that it is more voluminous.	3. The organ is nearly always inclined to the right.
4. A complete effacement of the umbilical depression, the dilatation of the ring, and sometimes a pouting of the navel.	4. More violent active movements of the fœtus.
5. Numerous discolorations on the skin of the abdomen.	5. Sounds of the heart and abdominal souffle.
6. Sometimes a varicose and œdematous condition of the vulva and inferior extremities.	6. Ballottement is very evident during the seventh month, but more obscure in the eighth.
7. Deeper discoloration of the central areola, and an extension of the spotted areola. Sometimes there are numerous stains on the breasts; flow of milk; complete development of the glandiform tubercles.	7. The softening extends along the neck, above the vaginal insertion. In primiparæ, the cervix is ovoid, and seems to have diminished in length; in others it is conoidal, the base being below, and sufficiently patulous to admit all the first phalanx. The neck at its superior fourth is still hard and shut up.
8. Persistence of kyesteine in the urine.	

First Fortnight of the Ninth Month.

1. The vomitings frequently reappear.	1. The fundus uteri reaches the epigastric region and gains the border of the false ribs on the right side.
2. The abdominal tumor has increased; the skin is much stretched, and very tense.	2. Active movements. Sounds of the heart and abdominal souffle.
3. Difficulty of respiration.	3. Often there is no proper ballottement, but merely a kind of rising of the tumor formed by the head.
4. All the other symptoms persist, and are increased in intensity.	4. The neck is softened throughout its whole length, excepting the circumference of the internal orifice, which still

RATIONAL SIGNS.	SENSIBLE SIGNS.
	remains closed and resisting. In women who have previously borne children, the finger may be introduced into the cervix to the extent of a phalanx and a half, and in fact is only arrested by the internal orifice, which is closed and wrinkled, though, in some cases, already beginning to open. In primiparæ, the softening is equally extensive, and the neck is swollen in the middle in an ovoidal form; but the external orifice, although partially opened, does not permit the introduction of a finger.
Last Fortnight of the Ninth Month.	
1. The vomitings often cease.	1. The fundus uteri has sunk lower than in the first fortnight.
2. The abdomen is fallen.	2. Active movements; sounds of the heart and bellows murmur.
3. The respiration less oppressed.	3. Ballottement often imperceptible.
4. More difficulty in walking.	4. The head more or less engaged in the excavation.
5. Frequent and ineffectual desires to urinate.	5. In *multiparæ*, the internal orifice softens and dilates; the finger can then penetrate through a cylinder, as it were, an inch and a half in length, and come into contact with the naked membranes. In *primiparæ*, the internal orifice experiences the same modification, but the external remains closed. During the last week, in consequence of the spreading out at the internal orifice, the whole cavity of the neck becomes confounded with that of the body, and the finger, in reaching the membranes, only traverses a thin orifice in primiparæ, but a rounded collar in the others of a variable thickness.
6. Hemorrhoids; augmentation of the œdema and varicose state of the lower extremities.	
7. Pains in the loins, and colics.	

CHAPTER VII.

OF TWIN PREGNANCY.

THE term compound or multiple pregnancy has been applied to that in which two or more fœtuses are inclosed in the uterine cavity. Certain females seem to be greatly disposed to these anomalies; thus, cases are recorded where six, seven, and even eleven children have been born at three successive confinements.

Double pregnancies are quite frequent: that is, one case is met with in about seventy or eighty labors. Triplets, on the contrary, are very rare, since there were but five in the records of 37,441 accouchements that occurred at La Maternité in Paris. Further, we cannot call in question those instances in which there were said to be four at a birth; for such men as Viardel, Mauriceau, Hamilton, and many others, furnish examples of it.[1] Both Peu and Lauverjat declare that they have witnessed cases of five at a birth.[2] And lastly, must we consider those cases of six, seven, eight, and

[1] The following statistical account is extracted from Churchill's work. In 161,042 pregnancies, there were 2477 cases of twins, or 1 in 69, and 36 triplets do., or 1 in 4473 (English accoucheurs).

In 36,570 pregnancies, there were 582 cases of twins, or 1 in 110, and 6 triplets, or 1 in 6095 (French accoucheurs).

In 251,386 pregnancies, there were 2967 cases of twins, or 1 in 84, and 35 triplets, or 1 in 7185 (German accoucheurs).

Total, in 448,998 cases, there were 5776 instances of twins, being 1 in 77¾, and 77 triplets, or 1 in 5831.

The same author furnishes the accompanying information as to the sex of the twins: Dr. Joseph Clarke states, that in 184 twin cases, both children were boys 47 times, girls 68 times, and one boy and one girl 71 times.

Dr. Collins reports 240 cases, in which there were two males 73 times, two females 67 times, and male and female 97 times; and Dr. Lever 33 cases, two males 11, two females 11, and male and female 11.

[2] M. Pigné informed me that he saw a single placenta at Strasbourg, from which five separate cords arose, although only a single sac existed, which was composed of three membranes, decidua, chorion, and amnion, in which the five embryos were inclosed.

Dr. Kennedy (*London Med. Gazette*) presented to the Royal Society the history of a woman who aborted at three months of five embryos. There were three ovums, one being double, and each ovum had a placenta and its own proper membrane.

M. Bourdois (*Gaz. Méd.*, p. 569, 1850) describes a quadruple pregnancy, in which the delivery occurred at the seventh month. The second child was born twelve hours after the first, and the other two a few minutes subsequently. The second accouchement was attended by a new discharge of waters; there were two placentas, one of which had three cords and was adherent, and some portions of it remained behind in the uterus.

Dr. Hull, of Manchester, deposited five little twin fœtuses in the Museum of the London College of Surgeons, that he had obtained from a woman who aborted at the fifth month of gestation.

Chambon records an instance of quintuple pregnancy, where the children survived their baptism.

A woman of Naples was delivered of five infants at seven months. (*British and Foreign Med. Review*, 1839.)

Dr. Kennedy (Every) states (in the *Dublin Med. Journal*, Jan. 1840), that a woman

nine children, or even more, at once, so many examples of which are found in the authors, as true statements or as fabulous tales?

It is a very difficult matter to point out the causes of this anomaly in the present state of our science; true, numerous explanations have been offered, but all are nothing more than pure hypotheses: for example, it is said that a single fecundation may affect both ovaries, or two of the Graafian vesicles in the same ovary; and again, that several impregnations may occur successively in a short period, that is, before the first fecundated ovule has arrived in the uterus. Both take it for granted that two ovules are detached, either at the same time or successively, from the ovary, and, consequently, that two corpora lutea are developed. Several well-attested facts prove, however, that a different state of things may take place; thus, for instance, two ovules have sometimes been found in the same Graafian vesicle, and it is evident that the rupture of this vesicle alone, in such a case, might produce a double fecundation; at other times, two yolks have been seen in the same ovule, and in such a condition a twin pregnancy might certainly occur, although but one ovule be fecundated.

Hereafter we shall see, that these peculiarities serve to explain the varied disposition exhibited by the membranes be compound gestations.

It is frequently possible to recognize the presence of twins during pregnancy; indeed, the abdomen is ordinarily more voluminous then than at other times, and the belly is generally flattened on the median line, instead of presenting there a well-marked protuberance; the middle is depressed, in consequence of the two children lying one upon each side; nevertheless, this sign may fail when one child happens to be placed before the other.

The form of the uterus varies also with the position of the fœtuses, their number, and the amount of amniotic fluid. Thus, when the head of one is above, and that of the other below, there may result therefrom two corresponding depressions and projections, as M. Hergott has represented. Should both present by the head, the fundus of the womb will be very much dilated, and the contrary is the case when they present by the pelvis. In a case which occurred at the Clinic of Strasbourg, the shape of the womb was irregular and oblique; the two heads occupied the angles of the uterus, and formed two tumors separated by a depression; the one at the right being much the higher. The twins were born by the feet.

Fig. 73.

The slight blows perceived by the mother are sometimes felt at one and the same time in two distant parts of the abdomen; and the importance of auscultation as an element in this diagnosis has already been pointed out. (See p. 256.)

aborted of five embryos between the second and third months of gestation; and finally, Dr. Francis Ramsbotham has collected three cases of quintuple pregnancy from the public journals.

The bellows murmur can, I think, rarely furnish useful information. Still, it is asserted by Hohl, that in sixteen twin pregnancies, the murmur was heard seven times on both the right and left sides simultaneously, and nine times on one side only; and he affirms, that when the latter was the case, there was a common placenta, whilst in the other instances there were two. He is also of the opinion, that a double souffle is diagnostic of a double pregnancy, even though the sound of the heart be heard at a single point only. We cannot admit the last conclusion, since we have already denied the very relation which Hohl would establish between the seat of the murmur and the insertion of the placenta; besides which we have often heard a souffle on both the right and left sides in single pregnancies.

Again, as the two fœtuses mutually interfere with each other, neither of them presents itself to the vaginal touch; and of course the ballottement is then exceedingly difficult, if not wholly impossible; for, even if the finger should easily reach the presenting part, the presence of another child would interfere with the ascending movement of the first. Desormeaux, however, cites a case where the ballottement was manifest in a twin gestation, but even here a large quantity of water was present at the same time. Whilst in charge of the Clinic of the Faculty, in 1845, I observed on two occasions the same fact noticed by Desormeaux; for the existence of dropsy of the amnion rendered the ballottement very perceptible, although two children were present.

The course of twin pregnancies is sometimes accompanied by peculiarities which it is important to be acquainted with. Thus, the two fœtuses do not always attain to the development which we have indicated. One of them may die, and yet the other continue to grow. In such cases, which, however, are rare, the dead body may remain in the womb, where it hardens, withers, and is expelled during labor.

In my course of 1853, I exhibited a placenta obtained from a woman who was delivered at term of a living and well-developed child. It was provided with two amniotic bags, one of which belonged to the living child, and presented no unusual appearance. The other, which was much smaller, contained barely a trace of fluid, but inclosed a small mummy-like fœtus, about the size of one of four months' development. On the other hand, the dead fœtus may irritate the uterus, bring on contractions, and be expelled, whilst the other remains and is developed as usual.

Lastly, the twin that perished during pregnancy may still remain in the womb, in consequence of the adherences which its placenta has contracted with that organ, for a long period after the expulsion of its living brother, that occurs at the ordinary term of gestation.

Guillemot furnishes one of the most curious observations of this kind (*Heureux Acc.*, livre ii. p. 225) on record, in which the artificial extraction of the dead body did not take place until two years after the accouchement. But what is the cause which thus determines the death of one fœtus?

Mauriceau and Peu thought it might be attributed to the fact that one child, by receiving all the nourishment, becomes strong and vigorous at the expense of the other, thereby rendering it feeble and languishing, and causing its early death.

M. Guillemot believes that one child, in its growth, gradually compresses the second against the uterine wall, and the latter, not having sufficient space for its development, soon after dies. Lastly, M. Cruveilhier explains the atrophy of the fœtus by a gradual separation of the placenta, founding his opinion on a single case, in which the hemorrhage was great enough to account for the early death of one of the twins; but in the greater number of cases that have been recorded, no mention whatever is made of any hemorrhage during the pregnancy; whence, of course, the opinion of M. Cruveilhier would not be applicable to them. For my own part, I believe these cases, in which the death and atrophy of one fœtus takes place, should rather be attributed to some disease of the infant or placenta, or of some parts of its envelopes. It may be urged, indeed, that these alterations are not observed at the time of accouchement, which is not to be wondered at, considering the state of degeneration exhibited by all parts of the ovum; and, although no positive fact sustains this opinion, it seems to me more admissible and more rational than the others.

It not unfrequently happens that twin pregnancies terminate before full term, owing, doubtless, to the great distention of the uterus, which is often as large at seven or eight months as in a simple pregnancy at nine months. The same labor generally suffices for the expulsion of both, though such is not always the case; for, after the first child is born, the uterus may retract upon the remaining twin, and leave it unexpelled for eighteen or twenty-four hours. A still longer interval, several months even, may separate the two parturitions; and it is upon such facts as these that some persons have improperly admitted the doctrine of superfœtation. A reference to the latter is, however, unnecessary to explain these observations, for the cause of premature delivery is dependent solely on the enormous distention of the uterus, because as soon as one infant is expelled the womb retracts, the cause of irritation no longer exists, and we can readily conceive that the gestation may continue on until term. A child born at seven months may live equally well with one delivered at the end of pregnancy.

The peculiarities just studied in twin pregnancies may also present themselves in cases of triplets, &c. Thus, in a case cited by Portal, after the delivery of the first child and its placenta, which were healthy, he was obliged to extract two others that had apparently been dead for a long time, and were thoroughly dried.

Again, the membranes are not always disposed in the same manner in these pregnancies; and on this head we may admit, with M. Guillemot, who has particularly studied the subject, four distinct varieties: thus, in the first, two ovules are fecundated, and each embryo becomes developed, and is surrounded by its own proper membranes; in the second, the ovule contains two germs, though each fœtus has but a single envelope, the chorion being a common membrane; in the third, both embryos are inclosed in a single cavity, which appears never to have been divided by any membranous diaphragm; and, finally, the last variety is met with when the ovule contains a second germ, and both become developed together, which gives rise to what are called monstrosities by inclusion. Adopting this classification

as the basis, let us now proceed to the different modes of termination presented by these pregnancies, according to the species to which they belong.

1. In the first variety, both ovules are developed, retaining their proper membranes, the chorion and amnion; at first, each ovum has its own reflexed decidua, but generally that portion of the latter which forms the partition is very thin, and becomes absorbed as the gestation advances, and a single decidua then appears to envelop both.

The two chorions repose against each other, being only separated by some very fine areolar tissue, so that the children are divided by one very thick partition composed of four layers. The placentas are sometimes separate, though usually confounded with each other, or else are united by a kind of membranous bridge; but, notwithstanding the continuity of tissue, there rarely exists any vascular communication between them, and this fact is so uniform that the exceptions to the law are very rare indeed. From all which it must therefore be evident that two distinct ovules have been fecundated, whether they are deposited separately, or are contained in the same vesicle. The first variety is the most frequent.

2. In the second variety of compound pregnancy, the chorion is common to both twins, and each fœtus has but a single envelope formed of the amnion—the two laminæ of which, resting against each other, constitute the median partition. MM. Dance and Mancel have furnished an example of this variety in which there were but two children. Brendelius reports that a woman was delivered of two girls after three days' travail, but she died before the extraction of the third infant, which was found dead on opening her body; the placenta was single and very large, and the chorion had been common to all three, although each fœtus had a distinct amnion.

There is therefore only a single placenta, and a communication nearly always exists between the ramuscules of the two cords, as I have verified myself, on a placenta, which was presented by one of my former pupils, an Interne of the Ursuline Hospital, where he obtained it. In this, as in the preceding variety, one fœtus may die, the other continuing to live; but it is easily foreseen that an expulsion of the two children cannot take place separately.

3. Further, it may happen that the fœtuses are not separated by any partition, and are all shut up in the same amniotic cavity; and to the examples of this kind, already cited, I may add a case observed by my friend and colleague, Dr. Fournier. The two cords arise, most frequently at least, from a distinct point of the placenta; but sometimes they are observed to come from a common trunk, which bifurcates at a variable distance from the placental surface. In this variety, the expulsion of one fœtus must evidently be followed by that of the other; but I do not know to what extent we can justly say that the death of one necessarily endangers the other's life, if not speedily delivered by nature. (Baudelocque.) This inclusion of two fœtuses in the same amniotic cavity is often met with in those cases where one of them is destitute of an important part of its body: thus, the monstrosity that I presented to the Royal Academy of Medicine was inclosed in the same sac with its twin brother.

But it is nearly or wholly impossible, in the present state of *ovological* knowledge, to explain this strange anomaly, the existence of which, however, has several times been clearly verified.

In accordance with what we have said respecting the formation of the amnion (see Art. *Ovology*), this membrane emanates from the embryo itself, and consequently the amniotic membranes should equal the fœtuses in number; but, without admitting the theory of Pockels and Serres on the development of the amnion, a theory which, notwithstanding its want of probability, derives, from the facts alluded to, a certain degree of support, we cannot explain them but by supposing that two amniotic membranes existed primitively, and that the partition produced by their contact has been somehow destroyed. Most generally, there are numerous communications existing between the umbilical ramifications, as we have stated, when the chorion, and especially the amnion, are common to both, which is not always the case. Thus, Dodd reports a case of triplets, where the placentas were consolidated into one, two of the children being inclosed in a common chorion, whilst the third had a special one; the umbilical vessels did not communicate with each other. In another instance, recorded by Davis, the three fœtuses had a common decidua; two of them were surrounded by the same chorion and amnion, but the third had its chorion and amnion distinct from the others; the placenta formed a single mass, but the vessels had no communication with each other. (*London Med. Gazette*, 1841.)

4. Finally, the fourth variety of compound pregnancy that we have admitted, along with M. Guillemot, constitutes what has been called a *monstrosity by inclusion*. It consists of the complete inclusion of the elements, whether more or less numerous, of one fœtus in the body of another fœtus, which is otherwise well formed.

TABLE FOR CALCULATING THE PERIOD OF UTERO-GESTATION. (*Smith.*)

NINE CALENDAR MONTHS			TEN LUNAR MONTHS	
FROM	TO	DAYS.	TO	DAYS.
January 1	September 30	273	October 7	280
February 1	October 31	273	November 7	280
March 1	November 30	275	December 5	280
April 1	December 31	275	January 5	280
May 1	January 31	276	February 4	280
June 1	February 28	273	March 7	280
July 1	March 31	274	April 6	280
August 1	April 30	273	May 7	280
September 1	May 31	273	June 7	280
October 1	June 30	273	July 7	280
November 1	July 31	273	August 7	280
December 1	August 31	274	September 6	280

EXPLANATION.—The above obstetric "Ready Reckoner" consists of two columns, one of calendar, the other of lunar months, and may be read as follows: A patient has ceased to menstruate on July 1; her confinement may be expected at soonest about March 31 (*the end of nine calendar months*); or at latest on April 6 (*at the end of ten lunar months*). Another has ceased to menstruate on January 20; her confinement may be expected on September 30, plus 20 days (*the end of nine calendar months*) at soonest; or on October 7, plus 20 days (*the end of ten lunar months*) at latest. (Playfair.)

PART III.

OF LABOR.

LABOR is that function which consists in the spontaneous or artificial expulsion of a viable fœtus through the natural parts of generation. The term *labor* is used more especially to designate the expulsion of the child; the expulsion of the placenta being treated of under the head of *Delivery*, of that organ.

This definition of labor, differing as it does somewhat from those given by most modern writers, has the advantage of furnishing me a basis whereon to found a practical division; for when the expulsion of the fœtus takes place from the efforts of nature alone, it is called a *spontaneous*, or a *natural* labor; but when nature is inadequate to the accomplishment of this effect, and art is obliged to intervene, the delivery is said to be *artificial, laborious*, and also (though improperly) *unnatural*.

This function has also received different denominations, according to the period of pregnancy at which it is manifested: thus, it has been named *legitimate, timely*, or *at term*, when occurring within a week before or after the expiration of the ninth month. On the contrary, it is called *premature* or *precocious*, if it takes place during the seventh, the eighth, or the beginning of the ninth month. Again, the latter may be spontaneous or artificial, according to whether it is simply the work of nature or has been brought on by the intervention of art. This last case should be carefully distinguished from what the ancients called *forced labor*, in which they not only provoked the manifestation of the uterine contractions by a more or less direct irritation, but effected the delivery at once.

Lastly, it is called *tardy*, or *retarded*, when the delivery is not accomplished before nine months and a half or ten months.

At whatever period delivery may occur, it is always effected under the influence of the same forces; though there is an important distinction to be established in the phenomena, constituting what practitioners are agreed to call the *labor*. Whenever we examine carefully the whole of those phenomena, we can readily make out two very distinct orders of facts. The one is nothing more than an expression of the vital action brought into play for the expulsion of the fœtus, while the other is constituted of the successive movements which the child itself executes during such expulsion; the first is purely physiological, the second embraces the mechanical phenomena of the labor. Though often confounded in practice, these two orders should be carefully distinguished in theory.

We shall therefore have to examine, in as many separate chapters, the causes and physiological phenomena, as also the mechanical phenomena both of labor properly so called, and of the delivery of the placenta.

Again, although in the vast majority of cases the woman is really able to deliver herself, yet there are many precautions which the accoucheur should bear in mind, and a series of little attentions he must give to the patient in the course of the parturition; besides, the child will likewise require his intelligent aid, either during the travail or immediately after its birth, and therefore we shall devote a chapter to the exposition of those attentions and precautions.

We shall, in the first place, enter upon the study of natural labor at term, spontaneous premature delivery, retarded labor, and natural delivery of the after-birth; leaving the subjects of difficult labor and preternatural delivery of the placenta, to be treated of hereafter under the head of *Dystocia*. Premature artificial delivery will be described in connection with the other obstetrical operations.

CHAPTER I.

OF THE CAUSES OF NATURAL LABOR AT TERM.

THESE have been divided into the efficient and the determining causes.

§ 1. EFFICIENT CAUSES.

For a long time the fœtus was regarded as the principal agent of its own delivery, and as the chick breaks the shell of the egg, so it was supposed to effect the rupture of the membranes which contained it. The advocates of this opinion, which is no longer admitted, except by some persons out of the profession, relied chiefly on the fact of dead children being expelled more slowly from the womb, and with more difficulty than others; and further also because, in certain instances, the child has been known to escape from the uterus some time after the mother's death. But, in reality, these two facts have no value whatever in the question before us; for the death of the fœtus, when recent, does not materially retard the parturition, and writers were altogether in error as to the influence attributable thereto.

The living infant is expelled more rapidly, not in consequence of being the agent of its own discharge, but because its movements irritate the uterus and solicit its more frequent contractions; after its death the organ is, on the contrary, deprived of that natural irritant. Besides, whenever the fœtus has been defunct for a long time, another cause of retardation is added to the former; for where the product of conception has undergone a partial decomposition, the contractility of the uterine walls is unfavorably influenced thereby. In fact, the vitality of the organ seems to be in relation, to a certain extent, with that of the inclosed body; the blood being no longer attracted thither by the ordinary stimulus, does not reach there in such large quantities as before, and consequently the greater vital activity usually manifested in gestation is lost; hence arise atony of its walls, an excessive feebleness of its contraction, and slowness of the labor. Again, the fœtal trunk, being softened by the changes before described, collapses, as it were, and ceases to offer that resistance to the uterine wall which is necessary to the

energy and the maintenance of its contraction. Therefore, if it be true that the death of the infant renders its delivery more difficult, it is solely from the unfavorable influence that this occurrence may have over the exercise of the organic contractility.

Instances of children having been delivered spontaneously after the mother's death are quite numerous, and this is the strongest argument adduced by those who believe that the fœtus is the principal agent in the expulsion. But numerous observations, among others those related by Dr. Planque (in *La Bibliothèque de Médecine Choisie*), prove that those infants were dead even before the mother. Now these facts, extraordinary as they appear, can be very naturally explained as follows: Supposing the delivery took place shortly after the parent's death, the motor faculty of the uterus is not so dependent on the nervous system as to be entirely lost immediately upon the cessation of vitality in the latter, and is evidently retained for some time after the mother has succumbed. Thus, Leroux has observed the uterus contract a quarter of an hour after the last breath; and Osiander, after having performed the Cæsarean section on a corpse, found the uterus as much contracted the next day as it usually is in a woman just after her confinement. It is, therefore, very natural to suppose that such deliveries are owing to the contractile action of the womb, which, says Desormeaux, it, like other hollow muscles, still preserves for some time after death;[1] and finally, let us add, that the real death in many cases may have been preceded by an apparent one, and possibly that the former may not have occurred until just at the instant of, or immediately after the delivery took place. But when the expulsion of the fœtus did not occur before the lapse of two or three days, we must suppose, with M. Velpeau, that the labor was well advanced at the time of the mother's death, and gas being rapidly produced in large quantities in the intestinal canal, the uterus was thereby mechanically compressed on its exterior, and the ovum consequently forced out entire. Perhaps the subjoined case, reported by Hermann, might be explained in that way. (*Edin. Med. and Surg. Journal*, New Series, No. vi p. 431.)

A young woman died in her tenth month, and the third day after, the

[1] Dr. Tyler Smith states that the reflex action may continue for some time after the complete cessation of the respiratory movements, and in some cases be powerful enough to effect the delivery when the patient has died during labor; but that, in most instances, the *post-mortem* expulsion of the fœtus is due to a peristaltic contraction of the uterine fibres. We find it difficult to admit the existence of a vermicular contraction powerful enough to produce such a result.

M. Brown-Séquard has recently advanced what he regards as an explanation of this posthumous contractility. According to this learned physiologist, the contact of venous blood with the muscular fibre is sufficient to stimulate it to contraction. I have observed, he says, movements in the uteri of recently killed animals, whose spinal marrow had been destroyed throughout its length. I have seen these same movements in the uterus extracted from a living animal. These, which could not be attributed to reflex action, since there was no opportunity for the exercise of nervous influence, were due simply to the contact of non-oxygenated blood, to prove which he relates the following experiment. The spinal marrow in two Guinea-pigs, which had reached the end of gestation, was destroyed from the sixth rib to the sacrum, yet labor began and ended shortly after a ligature was drawn tightly around the trachea.

attendants noticed a strange noise about the corpse. A physician was hastily summoned, who found that twins, still inclosed by the intact membranes, had been just delivered. The children presented no traces of putrefaction, the placenta alone showing a commencing alteration.

But, besides these, numerous other objections still remain against this theory: 1. The delivery exhibits nearly the same phenomena, at whatever period of gestation it takes place; now, can any one suppose that the fœtus, which scarcely moves at all in the early months, can at once acquire a sufficient degree of strength to overcome the great resistance made at that time by the uterine neck? 2. It is well known, that, if the child present by any other part than the head in labor at term, the presenting part is so high up, before the rupture of the amniotic pouch, that it can in no wise contribute to the dilatation of the os uteri. 3. Again, the fœtal efforts certainly ought to affect the bag of waters first, and therefore a rupture of the enveloping sac should always be among the earliest phenomena of the labor; however, such a rupture often does not occur until the very last moments; sometimes even the ovum escapes entire. 4. Would it be possible for the most healthy and vigorous infant to make any exertions strong enough to surmount the resistance opposed to its delivery in some of the instances of tedious labor? &c., &c. From all which we may conclude that the fœtus has no influence over its own expulsion, and that the efficient cause of the delivery evidently belongs to the contraction of the uterine walls, aided by that of the diaphragm and the abdominal muscles.

Furthermore, to be convinced that the womb acts the principal part in this process, it is only necessary to examine a woman during labor, and, more especially, to introduce the hand into the uterus in a case of difficult version. It is its contractions alone which generally produce the dilatation of the os uteri, thus preparing a way for the child's passage; and they also perform the most important part in the later periods of the labor. They are even capable of effecting the delivery themselves. Thus, for instance, the parturition does not the less take place in animals, where the belly is laid open, and the abdominal walls thereby rendered incapable of any further action. It also takes place in women affected with procidentia uteri,[1] as also in those who suffer from a paralysis of the abdominal muscles, in consequence of an affection of the spinal marrow, or some one of the nervous centres. Finally, the use of anæsthetics within certain limits, destroys the contractility of the voluntary muscles, together with the sensibility; yet the uterine contractility remains, and the delivery is accomplished. Ordinarily, however, in the second or expulsive stage of the labor, the uterine contraction is assisted by the simultaneous action of the diaphragm and abdominal muscles.

At the moment when the head clears the neck of the uterus, especially when by pressing strongly upon the floor of the pelvis it distends the perineum, compresses greatly the lower part of the rectum and neck of the

[1] According to the report of Burdach, Wimmer has actually known the labor to take place regularly in a woman whose womb formed a tumor between her thighs, eleven inches long and seven and a half inches broad; the opening in which was directed downwards.

bladder, and opens and dilates the vulva, the pressure upon these parts is so violent that instinctively, not to say involuntarily, the woman exerts herself powerfully, in order to relieve herself as soon as possible from the insupportable sensation. Thus, fixing her feet firmly against the foot-board of her bed, and clinging to anything around that may offer a solid resistance, the patient takes a full inspiration, dilates her chest, and then, retaining the inhaled air in her lungs, she strongly contracts all the muscles forming the abdominal inclosure. This auxiliary contraction is so evident that nobody can doubt it, and authors only differ as to the kind of aid it brings to the uterine forces. Haller and others considered the uterine contractions as being merely secondary, and attributed to the abdominal muscles the principal part in the expulsion of the child; thus they suppose that the contraction of the organ simply serves to support the fœtal trunk, to embrace it properly like a cylinder, and to prevent the great pressure of the diaphragm from crushing it in, while at the same time the act of inspiration and the contraction of the abdominal walls force it outwards. But, from the facts before stated, we may judge of the value of this hypothesis. True, in certain cases of excessive feebleness of the uterus, and of a complete inertia of its walls, the abdominal muscles have proved sufficient to terminate the delivery; yet how much oftener has it happened that the woman, exhausted by antecedent disease, and left without energy or strength, has been unable to assist the womb by any voluntary contraction whatever!

Again, some women have been delivered during hysterical or epileptic fits, in a state of total loss both of feeling and movement, where evidently the uterine contraction alone could accomplish it. This harmony of action is therefore useful but not indispensable, since the labor will often terminate under the sole influence of the uterine forces; but it will be nearly always impossible in cases of total inertia of the organ, however powerful the contractions of the abdominal muscles may be.

The researches of Cloquet and Bourdon on the physiology of the process do not warrant the supposition of any active pressure by the diaphragm on the upper part of the uterus. They have proved, in fact, that the principal phenomena consist in a change of the acts of respiration, and that the object of such change is to furnish a solid point of insertion to the muscles passing from the chest both to the trunk and upper extremities. When the air has penetrated into this cavity, the glottis closes spasmodically; the abdominal muscles begin to contract; they press back the viscera, in the cavity of the peritoneum against the diaphragm; the latter contracts in turn; and, being sustained above by the resistance from the air contained in the lungs, gives to the base of the chest a degree of immobility and solidity, which affords a fixed point for the muscles inserted there; so that, in the effort of expulsion, the diaphragm, by its contraction, only exhibits a power of resistance sufficient to sustain the thoracic parietes, but not an active force, which is to operate, like the abdominal muscles, directly on the uterus.

On the whole, then, the efficient cause of labor is inherent in the womb itself. Its contraction alone is brought into play during all the first half of the labor; but it is aided in the second period by the abdominal muscles, which become more and more active as the labor draws towards its termina-

tion. Most generally the uterine contractions would be sufficient, but the abdominal contraction alone could scarcely ever complete the delivery.

§ 2. Determining Causes.

This name is applied to everything that can determine the action of the efficient causes; and, as before stated, this class consists both of unnatural and natural causes. The second only claim our attention here. The regular and almost fixed period at which the gestation terminates in the majority of women, has, in all ages, claimed the attention of physiologists. By some, the determining cause of labor has been attributed to the child, and by others to the womb.

1. According to the partisans of the first opinion, the fœtus, having arrived at a certain stage of development, will have acquired such a degree of muscular power that the resulting movements of its limbs will produce such blows and shocks upon the uterine walls, as will irritate the organ and determine its contraction. 2. The weight of the infant might also lead to the same effect. 3. Being confined in the uterine cavity, whose dimensions have not augmented in proportion to those of the fœtus, the latter will be incommoded. 4. Suffering from the prolonged accumulation of meconium in the intestinal canal, of urine in the bladder, and from its contact with the amniotic fluids, which ultimately acquire acrid and irritating properties, and no longer finding in the materials furnished by the mother the elements necessary to its nutrition and respiration, the infant will experience a necessity of changing its residence, of seeking a medium more suited to its ulterior development; which necessity will prove an instinctive desire of escaping from the surrounding inconveniences, that will cause it to give itself, so to speak, the signal of departure. Surely, it is only necessary to present such reasons as these in a summary manner, to obviate the necessity of refuting them. In short, the fœtus is as foreign to the determining as to the efficient cause of labor. The opinion favorable to the cause residing in the uterus rallies around it a greater number of partisans, but all of these do not explain the mode of action in the same way. Thus, according to some, the womb only possesses the faculty of distention to a certain degree, and, when carried beyond that limit, the walls react and contract; others believe that the term of nine months is assigned by nature for the fulfilment of the new organization of the womb; and having acquired at that period all the qualities necessary to the accomplishment of the great function to which it is destined, it immediately enters into action. But most of the modern accoucheurs consider the following explanation as the more reasonable.

Observation proves, say they, that the fundus and body of the uterus are the parts first distended, for the purpose of forming the cavity which incloses the product of conception; and the cavity of the neck subsequently participates in the dilatation, which begins at its upper part, then gradually descends, so that the ring formed of the external orifice has alone undergone but little alteration at the approach of labor. Again, the walls of the neck whose tissue is denser and more resistant than that of the body, undergo certain changes, which follow the same progression in dilating as the cavity

does; their tissue is saturated with juices; they soften and become supple; their fibres unfold, as it were, are elongated and developed; and, consequently, the resistance of the neck to the escape of the ovum progressively diminishes as the term of gestation draws near.

According to this view, the fibres of the neck are considered antagonistic to those in the body, the contraction of which latter is therefore reduced to a simple tonic action, so long as the resistance of the neck is superior to their power; but when this opposition is diminished by the progressive dilatation of the cervix, the orifice alone remaining, the fibres of the body then begin to act more evidently, and their contractions become more and more energetic. (*Dict. de Méd., en* 25 v.)

According to Ant. Petit, the body only will dilate prior to the sixth month; but at that period it commences borrowing from the cervical fibres the elements of its ulterior distention, to which it can no longer contribute itself; and such contributions will continue to be drawn during the last three months, and then, when all the fibres held in reserve by the neck shall have yielded, the distention being carried to the utmost, the accouchement will take place. M. Velpeau adopts nearly the same opinion. On the other hand, M. P. Dubois, who originally advocated the opinions avowed by Desormeaux in the first edition of the *Dictionnaire*, has since taught, in his course of 1837–8, the following theory proposed by Jones Power, in 1819.

The uterine tissue at term may be justly compared to that of the other hollow muscular organs: the bladder or rectum, for example; and, like these organs, it is formed of two muscular layers, the external of which has longitudinal fibres, and the internal has circular ones; it also presents a superior cavity, a dilatable and contractile reservoir, to which the structure just indicated principally belongs; as also a closed orifice below, formed solely by the circular fibres arranged as a sphincter muscle. It likewise resembles the bladder and rectum in having two orders of nerves — the sympathetic and the spinal; those coming from the ganglionic system are distributed to the body, while the others, derived from the nervous centres of animal life, go to the neck, which is a true sphincter for the uterus; the similitude is further maintained by the presence of a membrane lining its interior, and by being covered externally, though at the superior part only, by the peritoneum.

The agreements in structure are not the only ones claiming our attention; for the well-marked sympathies existing in the rectum or bladder, between the reservoir and its sphincter, are found quite as distinctly marked between the body of the uterus and its neck; for as an irritation of the neck of the bladder or the sphincter ani is capable of producing an urgent desire to urinate, or to go to stool, so irritations affecting the cervix uteri also solicit the contractions of that organ; moreover, it is well known that an extreme fulness or distention of the first-named organs acts mechanically in two ways: 1. By irritating their walls by the direct contact of the contained substances; 2. By dragging or pressing on the fibres forming the sphincter, and these latter reacting on those of the body. Now, who does not recognize in this resemblance, says Dubois, an easy

explanation of the determining causes of labor? For, so long as the cervix uteri retains a certain length, its most inferior fibres, those especially supplied by the nerves of animal life, and therefore enjoying a high degree of sensibility, are not exposed to any kind of excitation; but, towards the end of the gestation, and in consequence of the successive expansion at the superior part of the neck, its whole length has disappeared by contributing to the gradual development of the organ; a circular collar alone remaining, formed of the horizontal and the circular fibres, which appertain to the external orifice. The growth of the uterus cannot continue without producing a severe tension on the fibres of this collar; and further, being brought immediately into contact with the amniotic sac, and consequently with the presenting part of the fœtus, they must necessarily suffer, must be irritated and excited by this constant and unusual contact. As this double cause of irritation is constantly acting, it must inevitably happen with the fibres belonging to the body of the uterus, as it does with the rectal and vesical walls when their sphincter is irritated, *i. e.* they must immediately enter into contraction.[1]

Dr. Tyler Smith, of London, has lately endeavored to prove, in accordance with the observations of Carus, Mende, and Merriman, that the determining cause of labor must be sought for in the ovary; that natural labor always corresponds with the tenth menstrual period, and that the congestion of the ovaries produced, by reflex action, first a simple irritation, and ultimately true contractions of the uterine parietes.

Admitting as proved that the menstrual ovulation goes on during pregnancy, it would still remain to be shown why it should be rather at the tenth than at the eighth or eleventh period that this influence of the reflex action of the ovary should be strong enough to excite the contractions of natural labor in the uterus.

At one of the late sittings of the Biological Society (September, 1855), M. Brown-Séquard suggested a theory which doubtless is subject to objections, but which certainly is one of the most ingenious of all that have yet been proposed in reference to the determining cause of labor.

Like all the muscles, those especially of organic life, the muscles of the uterus are very sensitive to the contact of venous blood, and the carbonic

[1] Mr. Power cites the following case, communicated by his brother in support of his opinion, and which we bring forward as being interesting in many respects.

A lady, the mother of several children, supposed herself near the term of a fresh pregnancy, and she felt two or three slight pains; but they soon passed off again, and three months more elapsed without her experiencing any other pain. Becoming uneasy about her condition, she consulted several physicians, who, after having made the usual examination, declared she was not pregnant. The author's brother having been called in, participated at first in the same opinion; nevertheless, he found the abdomen greatly enlarged, and much inclined forwards, so that it descended in front of the thighs, almost down to the knees, when the patient was standing. A distinguished physician, a friend of the lady, who was present, then mounted on a chair above her, and by passing a towel underneath the belly raised it up; the vaginal touch being once more resorted to, the child's head was distinctly felt. A suitable bandage retained the tumor in that position, and four or five days afterwards the pains came on, and the woman was happily delivered of a very large living infant.

acid gas, which the latter contains in large amount, is capable of producing their contraction. Of the experiments tending to prove this, one certainly seems very conclusive. M. Séquard applied a ligature to the trachea of a pregnant rabbit. Six or eight minutes after the commencement of asphyxia, uterine contractions became manifest; the ligature was removed, the contractions ceased; it was again applied, and they reappeared.

Now, according to M. Brown-Séquard, at the end of gestation, the irritability of the uterine fibre is very great, and the development of the venous apparatus of the organ such, that a considerable amount of venous blood is contained within its walls. These two conditions together constitute, he thinks, the determining cause of the first contraction, since the excitability must necessarily be awakened by the prolonged contact of carbonic acid. The effect of the first contraction would be to expel the blood from the veins, and the contractions would cease promptly with the exciting cause, did not the pain which it occasions stimulate the reflex action of the spinal marrow; the latter, therefore, sustains it for some moments. But, as we shall state hereafter, the contractile power of a muscle of organic life is rapidly exhausted, its fibre relaxes, and repose soon succeeds to activity. This relaxation of the uterine fibre allows the venous blood to flow back into the uterine sinuses, so that after a time the series of phenomena just mentioned recommences.

I have contented myself with simply presenting the principal views that have been entertained as to the determining cause of labor, although it would be an easy matter to start numerous objections against all of them, which perhaps could not be set aside. Thus, the uterus is as much distended, in some cases, at eight months as it is in many others at nine, without the term of pregnancy being anticipated. The muscular organization of the uterus is as perfect several weeks before the two hundred and seventieth day as it is at a later period. The sort of antagonism fancied by some authors to exist between the fundus and the neck of the uterus, is a pure hypothesis unsupported by evidence; besides, this opinion, like that of Antoine Petit, rests upon a false observation, namely, that of the progressive shortening of the neck after the sixth month.

[It is universally admitted that delivery is effected by the contraction of the uterus, but the question has been raised, Why does this contraction take place at the end of gestation? On this point, Power's theory seems to have gained the assent of the majority of accoucheurs. It does seem to us, however, that the question has been badly put, for how can we believe that the muscular fibres of the uterus *do* remain inactive for nine months, and enter into contraction only at the termination of pregnancy? We feel justified in asserting that the uterus contracts throughout the entire period of gestation, feebly at first, and rarely, it may be, but more decidedly as the time progresses, so that it may not infrequently be detected by palpation of the abdomen at various periods.

The contractions are, doubtless, very slight at first, though real, and every one knows that they accomplish the effacement of the cervix at the end of gestation. Should an accidental cause increase their energy prematurely, the result is either abortion or premature delivery.

We would therefore reverse the question and ask why, if the contractions take place throughout the entire period of gestation, do they expel the ovum only at

term? The first reason to be adduced is, that the contractions, though feeble and insufficient at the outset, grow stronger as the development of the middle layer of the uterus progresses, but not until the end of the ninth month have the muscular fibres acquired sufficient contractility to effect the expulsion of the child. In the second place we would add, that the contractions which occur during the course of gestation, make a fruitless effort to dilate the firm and resisting tissue of the uterine orifice.

It is, therefore, by a wise precaution of nature that the softening of the cervix, which takes place from below upwards, reaches the internal orifice only after the expiration of the eighth month. The internal orifice then yields to the contractions which produce the gradual effacement of the neck from above downward. The term of gestation has now arrived, and the contractions increase greatly in strength. At this point only, would I have recourse to Power's theory, which seems to afford a true explanation of the recrudescence of the contractile forces of the womb and the prompt establishment of labor.]

CHAPTER II.

OF THE PHYSIOLOGICAL PHENOMENA OF LABOR.

For the purpose of facilitating the study of the phenomena of labor, most writers have divided them into several distinct groups, which they have denominated the *stages* of labor; and each one has built up his own classification, so that we may now enumerate some twenty or thirty. Of all these, the division of Desormeaux appears to us the most simple, and we shall therefore adopt it. His first stage extends from the beginning of the labor to the complete dilatation of the cervix uteri; the second includes all the interval from this time until the child is expelled; and the third embraces the delivery of the placenta.

Precursory Signs.—The *term* of gestation is most usually announced by a collection of symptoms, to which the majority of authors have applied the name of the "precursory signs of labor." Thus, during the last fortnight of pregnancy, sometimes a little sooner, at others, only five or six days before the delivery takes place, the uterus, which previously extended up to the epigastric region, sensibly sinks lower, and seems to spread out laterally; and the mechanical obstruction to the respiration being thus removed, the latter becomes more free; the stomach is no longer compressed, and digestion, if hitherto impaired, becomes more easy; the patient, no longer troubled with nausea and vomiting, and respiring more freely, becomes, it is said, gayer, more cheerful, and disposed to movement. However true this last proposition may be with regard to some women, it certainly does not apply to all; but, on the contrary, it has seemed to me that in proportion as the term approaches, their position becomes more and more distressing; and this, I think, may be easily explained; because if the respiration becomes more free, and the fundus uteri descends, the inferior part of the organ must also sink down in the same ratio. The head, when presenting, engages in the excavation, carrying the lower portion of the

uterus before it; it sometimes even reaches the pelvic floor, and consequently gives rise to an annoying sensation of weight about the fundament, to great pressure on the neck of the bladder and rectum, strainings at stool, ineffectual desires to urinate, vesical tenesmus, dysury, and sometimes even to strangury; the œdema and varices of the inferior extremities and genital parts then augment considerably; the hemorrhoidal vessels swell up, and the tumors of the same name, if they existed before, become more voluminous and very painful; at the same time copious glairy discharges escape from the vulva.

About the same period the pelvic ligaments become softened, and the gliding of the articular surfaces being rendered easier, the joints are more movable, and consequently walking is uncertain, painful, and sometimes even impossible. Lastly, to all these inconveniences and pains, another is often added, which singularly aids in making the woman's condition still more distressing; it is this: the uterus, in the last periods of gestation, seems, by contractions, which are short and distant at first, but soon increasing both in length and frequency, to prepare, as it were, for the more violent contractions of parturition. Indeed, she often experiences the true pains from time to time, and should the accoucheur then examine the abdomen, he, like her, will feel it hardening, and the uterus manifestly contracting. At times, these contractions are scarcely painful, are not attended with bearing down, and can only be detected by placing the hand upon the abdomen.

We know that the uterine globe is contracting, from its greater hardness; then, after a short time, relaxation occurs, and the walls regain their habitual suppleness.[1]

In women who have previously had children, we ascertain by the vaginal touch, that the membranes bulge out during contraction, and engage slightly in the upper part of the cervix uteri. These precursory phenomena are manifested much sooner in primiparæ than in others.

According to certain writers, the pains are felt first, and with more severity than at any other time, about four weeks before term; so that some women, who have been pregnant before, do not hesitate then to affirm that their labor will take place in the course of a month. (Burdach.)

Further, these pains are not wholly useless, for they tend to diminish the thickness of the neck, and generally bring on its dilatation; thus, I have remarked that, when no cause of dystocia existed, the labor was usually much more rapid in those females who had been thus tormented by frequent pains during the last fortnight of their pregnancy.

On the whole, therefore, contrary to the proposition reiterated in all the

[1] These contractions, which are the precursory symptoms of labor, I regard as due to the changes which the upper part of the neck undergoes in the latter weeks of gestation. We have already stated that, in the last fortnight, the internal orifice softens and yields to distention, then expands from above, so that the upper half of the neck gradually becomes confounded with the cavity of the body; the lower part of the ovum will evidently engage in the dilated portion, and soon come in contact with the parts in the neighborhood of the external orifice. This contact occasions a progressive irritation of the irritable fibres of the lower half of the cervix, which, by reacting upon the body, excites its contractions, until finally, the entire neck being effaced, the irritation reaches its maximum, and labor commences.

classical works, that *women are more gay, cheerful, and disposed to action*, I have observed that they are in general more sad, and are greater sufferers, than at other times; and although they appear to endure their pains better, it is simply because they are encouraged by the hope of a speedy delivery, the announcement of which is recognized in the very sufferings they endure.

First Stage.—The term of gestation finally arrives, and the labor begins. In primiparæ, this is made known by the opening of the neck, which until that time had remained closed; and in other women, by the total effacement of the rounded collar presented by the os tincæ. The pains just mentioned as occurring in the last fortnight of pregnancy, suddenly become more acute and frequent, and while they last the abdomen retracts, and the uterus hardens, as may easily be verified by examination. If the fundus was heretofore inclined towards the right or the left, it will now return to the median line; the inequalities of the fœtus can no longer be perceived through the abdominal wall; the cervix uteri, which is already somewhat dilated, closes partially during the pain, and its margins are tense and resistant, though growing thinner; the membranes are distended, press at first on the neck, then engage in it as soon as the dilatation is sufficiently advanced, under the form of a segment of a sphere, whose dimensions progressively increase with the dilatation.

The organs of generation are more humid; the glairy discharges are streaked with blood; the pains continue to increase in force and frequency, each one being ushered in by a slight shivering, or horripilation; while it lasts, the pulse is hard, frequent, and full; the countenance is flushed, the surface and tongue dry, and the patient very thirsty; nausea and vomiting often come on; she weeps, desponds, and becomes quite irritable, and, being unconscious of the progress of her labor, because no advance is perceived, she cries out repeatedly, that she will never get over it. After the contraction, she is less agitated; still, however, the cessation of the pain does not seem to be perfect, the calm is not yet complete, and the poor sufferer, still under the influence of the last pain, dreads incessantly the arrival of its successor. During the interval, the margins of the os uteri again become supple, thick, and rounded; the membranes that were smooth and tense, while the pain lasted, are now flaccid, and hang in folds, and the fœtal head, which was temporarily removed from the orifice, seems to return, and is much more accessible to the finger. In proportion as the contractions are repeated, the os uteri gradually dilates more and more, until at last it is completely opened; the cavity of the uterus and the vagina thenceforth forming but a single uninterrupted canal.

Some females are able to conceal these early pains, but most of them find it impossible to do so for any length of time; for, if conversing, they will at once leave the phrase incomplete, and remain silent until the pain has diminished or stopped altogether; or, if they happen to be walking up and down the chamber, they stop short and lean on a chair, or the first article that comes to hand, until it passes over.

The occurrence of violent shivering, and sometimes of general tremors, at the termination of this stage, is by no means unusual, and that, too, without any sensation of cold being perceived. The patient herself frequently

expresses surprise at her trembling. It is doubtless caused by one of the singular impressions produced upon the nervous system by the act of parturition.

Second Stage.—At length, under the influence of these first pains, the duration of which is very variable, the orifice is enlarged until it forms a sufficient opening; and from that moment all the uterine forces are directed to the expulsion of the foreign body contained within the organ. Up to this time, the uterus alone was concerned in dilating the neck, but it now seems to call in aid the contraction of the abdominal muscles, and consequently both the pain and the bearing down are carried to a much higher degree. The heat of the surface is much more considerable, the agitation extreme, and in some instances there is even a marked disorder in the intellectual functions. The pains are stronger, and the intervals shorter; nevertheless, the woman bears them with more patience, nay, she even assists them by voluntarily contracting all the muscles of the trunk; and each pain is followed by a calm more perfect than that in the first stage. Indeed, when the interval is rather long, some females, exhausted by the previous fatigue, sleep profoundly, and thus get a refreshing repose that should be respected, but which is soon interrupted by a new pain. The inferior segment of the membranes gradually engages in the orifice; the successive and repeated contractions cause the liquor amnii to flow towards this point; the amniotic pouch becomes tense and bulging at its lower part, and, being entirely unsupported by the parietes of the neck, it gives way, and the contained waters escape with more or less rapidity and abundance, according to circumstances.

Immediately, the fœtus, urged on by the same contraction, applies itself to the os uteri, and the head, if that is the presenting part, engages like a stopple in the orifice, thereby preventing a further discharge of the waters. The head is then said to be *at the crowning.* The rapid discharge of a considerable quantity of the waters, which then takes place, suspends the uterine contractions for several moments, and, as the head no longer presses on the circumference of the neck, a small amount of fluid is again discharged. But a more energetic pain shortly comes on, by which the child's head advances and clears the circle of the uterine orifice, and just at this moment the patient very frequently gives a loud cry, an expression of the great pain caused by its passage. Next, the head descends into the vagina, the transverse folds of which become effaced, the canal enlarging and elongating for its reception. When a rupture of the membranes takes place before the os uteri is completely dilated, the head often descends to the pelvic floor, though still retained in the womb, and does not clear the uterine orifice until it engages in the inferior strait; though, whichever happens, the pains go on increasing in violence. Each one is announced by a general shivering; the patient clings to anything around her, supports her feet against the mattress, throws the head backwards, takes a deep inspiration, and violently contracts all the muscles of her body. The fœtal head, being thus forcibly urged on, presses against the floor of the pelvis, and causes it to protrude at every pain; and the consequent pressure on the rectum gives rise to illusory desires of going to stool.

After a greater or less resistance, the perineum at last yields, becomes distended and bulging in front; the vulva partially opens, and the nymphæ are effaced, the skin in the neighborhood contributing to the enlargement; the head then appears in the dilated vulva, and the fæces as well as the urine are passed involuntarily; then the pain again ceases; the head, just apparent, now seems to re-enter the excavation; the overdistended perineum retracts from its own inherent elasticity; the labia externa approach each other, and the vulva again closes up; at each pain, the latter opens more and more, then retracts, until, at last, all these parts, from the force of the repeated contractions, become incapable of any further resistance;[1] finally, a horrible pain comes on, forcing loud cries from the woman, which is made up of two others of unequal violence, for which nature seems to have reserved all her powers; this first brings the parietal protuberances to a level with the tuberosities of the ischium, and then expels the head altogether from the parts.

In some instances, the delivery of the body immediately follows that of the head; but in the larger number, some seconds elapse; then the pain is renewed, the uterus again contracts, and drives out the fœtal trunk, together with the rest of the amniotic liquid.

The rapid sketch of these phenomena, just given, has not afforded us an opportunity of dilating upon any of them; nevertheless, some ought to be studied more carefully. For instance, the pain, the dilatation of the uterine orifice, the glairy discharges, and the rupture of the membranes, demand a more particular attention. We shall, however, be brief in the physiological considerations appertaining to each.

§ 1. The Pain, or Contraction.

In most females, the pain is so inseparable from the contraction, that, in common language, the cause is readily confounded with the effect, and the two expressions are used, indifferently, to express the uterine contraction, its returns, duration, weakness, and intensity. We must remark, however, that although the intensity of pain is generally in relation to the contraction, yet it is not always so, for the perception of pain thereby produced necessarily varies with the susceptibilities of the patient herself. Some experience trifling pains very acutely, and express themselves freely; others, on the contrary, whose sensibility seems more obtuse, scarcely complain at all of the strongest contractions. Again, there are certain females who have the happy privilege of being delivered almost without any or at least with but very inconsiderable pains. For instance, I had an opportunity of observing a young primipara at the Clinique, who was aroused by the pains at four o'clock in the morning, and was delivered at six; she suffered so little during these two hours, that she did not consider it necessary to alarm any one, and the midwife was only summoned when the pain became a

[1] Certain authors attribute the retreat of the head after each pain to a winding of the cord around the child's neck, and therefore propose various measures for facilitating its delivery. But this simply results, says Baudelocque, from the elasticity of the perineum and the reaction of the muscles contained in its substance, as also from the elasticity of the cranial bones. Consequently, we have nothing to do but to await the spontaneous expulsion.

little more severe; she soon arrived, and found the head delivered. This case was still more remarkable, from the fact of a partition existing in the vagina, which divided its cavity into two parts; indeed it had been proposed to incise this septum when the hour of labor should arrive.

It is highly probable that the dilatation of the neck goes on quietly in such cases, under the influence of contractions which are not perceptible to the patient from being unattended with pain. The pains have received different names according to the period of their occurrence: thus, the trifling ones appertaining to the precursory phenomena of labor are named *mouches*, from a comparison with the sensation caused by the pricking of a fly; those of the first stage, in which the neck is dilated, are termed *preparative;* those of the second are designated as the *expulsive;* and finally, in the last moments of labor, when the head forcibly distends the perineum and partially opens the vulva, the pains are so violent in character as to have been denominated the *conquassantes.*[1]

The pains are felt in the lower part of the abdomen; and in the early stages, generally follow a line drawn from the umbilicus to the second bone of the sacrum, but when the head presses against the pelvic floor, they run more towards the coccyx. Sometimes they are felt in the lumbar and sacral regions only; the women then call them the pains in the back; and the patient has good cause for dreading them, for they do not much advance the delivery, and always leave behind them a feeling of discomfort and prostration. These lumbar pains often come on early in the labor, at other times a little later, but they rarely continue till its close; sometimes they coincide with a great obliquity of the uterus. According to Madame Lachapelle, they may generally be referred to too great a rigidity of the external orifice, either because this experiences a kind of cramp, or that owing to its unyielding condition it receives the full force of the uterine efforts, and consequently suffers more than when softened.

These lumbar pains doubtless depend on the sensibility of the orifice, and this can readily be explained by the origin of the nerves distributed to the neck, for the hypogastric and lumbar plexuses furnish them; whilst the ovarian plexus of the splanchnic nerve alone sends its branches to the fundus uteri. Various plans have been tried to assuage these pains: thus, venesection, emollient injections, and the opiates, have often succeeded; but there is one which, of itself, may suffice in many cases to relieve the patient, that is, to raise her up by passing a towel under the loins. The pains have been divided by writers into true and false, according to whether they are produced by a regular labor, or by some disorder in the uterine functions; but as we shall endeavor to establish the diagnosis carefully further on, we will only remark now, that a true contraction always commences in the fibres of the neck, and only reaches the fundus some seconds afterwards; and therefore every contraction beginning at this latter part is irregular and abnormal. (See chapter on *Attentions to the Woman during Labor.*)

[1] I give these terms (*mouches* and *conquassantes*) as found in the original, because, in our American practice, they have no synonyms; perhaps the words *pricking* and *tearing* would express their sense. — *Translator.*

The question now arises, what is the cause of the labor pain? Some suppose that it is produced by the tension of the fibres of the neck; others, by the pressure on the nerves distributed to the internal surface of the organ, which are necessarily compressed by the fœtal walls during the contraction; and lastly, certain accoucheurs have thought that it was owing to the compression of the parts contained within the pelvis: the nervous plexuses, for example. But these opinions err in being too exclusive, since all of these causes evidently contribute to the production of pain; indeed, there can be no doubt that the dilatation of the neck is painful during the first stage of labor, more especially when the head is clearing it, this being, according to Madame Boivin, almost the only source of suffering; though, on the other hand, when the child is so placed that it neither rests against the uterine orifice, nor yet on the superior strait, the contraction is still painful; and the pain must then be owing to the pressure on the nerves of the body of the womb. Again, in the last moments of parturition, when the head is passing the inferior strait, the perineum, and vulva, the enormous distention of those parts, and the pressure on each of them, must singularly add to the pain produced by the contraction, as well as contribute towards giving it that particular character known under the name of the *conquassante*, or tearing pain.

Without denying that these various conditions may be the first cause of the pain, M. Beau observes, that the suffering which they produce is not seated in the uterus, but in the lumbo-abdominal nerves. He regards the pains of child-birth as being, for the most part, a lumbo-abdominal neuralgia, precisely as though the case were one of pathological disease of the uterus. If, says he, a woman in labor be examined with the object of determining the existence of the five painful points which characterize the lumbo-abdominal neuralgia, there will then be found, as in disease of the womb, points which are painful on pressure in the lumbar, iliac, hypogastric, inguinal, and vulvar regions. In some cases, it is the lumbar point; in others, the inguinal or iliac, &c. Pressure on the same points is much less painful during the interval of the pains; in some cases, indeed, all tenderness then seems to disappear.

Though the localization of the pain in the lumbo-abdominal nerves may not explain its intimate nature and first point of departure, it at least enables us to understand the numerous varieties which it assumes; just as certain grave lesions, and some extensive displacements of the organ, are in some women attended with no pain, whilst with others a trifling disorder, or a slight displacement, gives rise to extreme suffering. Thus, some women suffer very little from powerful contractions, whilst others complain bitterly of the slightest expulsive effort. Here, as in the pathological case, it is impossible to fix a constant relation between the intensity of the abdominal neuralgia and the contractile action of the uterus.

The degree of pain, as M. Beau remarks, is owing here, as in all other neuralgias, to the nervous susceptibility of the female. We were, therefore, right in saying that the pain is not intimately connected with the contraction.

[The pain which accompanies the uterine contractions is not a unique fact in the organism, inasmuch as all rather severe involuntary contractions, in whatever organ they may take place, are attended with pain. I would mention in illustration, cramps in the muscles of the animal life, colic pains in the bowels, spasmodic contractions of the bladder, and palpitations of the heart. Under ordinary circumstances, it is true that the muscles of the limbs, of the intestinal canal, of the bladder, and of the heart, are constantly contracting without pain, but the moment they become affected with severe involuntary contraction, pain is experienced. This would seem to be a law of pathological physiology which is as applicable to the uterus as to any of the other organs. We believe, therefore, that the pains of labor have their seat in the uterine walls precisely as colic pains are situated in the walls of the intestines. The painlessness of the contractions which take place during pregnancy, is explained by their feebleness, and are comparable to the peristaltic motions of the bowels of which we are unconscious.]

Still another question has been agitated by physiologists, that is, why is the contraction intermittent? and here far-fetched reasons have been adduced to explain a very simple phenomenon; just as if any single muscle of the economy could contract permanently; as if it were not the nature of all muscular contraction to be interrupted by the fatigue of a too prolonged exercise, and as if it must not have an interval of repose, in order to preserve its activity. Besides, if the uterine contractions are dependent upon the nerves of organic life, why should they not be subject to the periodicity which marks the muscular apparatus supplied by branches from the great sympathetic? We are doubtless ignorant of the cause of the rhythmic intermissions in the contraction of the heart, as well as of the stomach and intestines; what cause is there, therefore, for greater astonishment at the intermittence of the uterine action, subject as it is to the same nervous influence?

It is certainly very curious to study the influence of the contraction over the mother's circulation, which exhibits, according to Holl, the following peculiarities during a pain. In general, the pulse is accelerated as soon as the contraction begins, increasing in frequency as it goes on, then diminishing, and gradually resuming the normal type. Now there exists so intimate a relation between these two phenomena, that, where the pulse is gradual in its acceleration, where it arrives little by little to the maximum of its rapidity, is there sustained for a certain length of time, and finally recedes by degrees, the pain also follows an equally regular course; it gradually attains its maximum intensity, remains a while stationary, and then decreases with the same regularity; but, on the contrary, if the pulse accelerates by jerks, the contraction will be short and precipitate, and therefore without effect. Holl ascertained this regularity in the phenomena, by counting the pulsations by quarters of a minute during the whole time a pain lasted. For instance, he noted the following variations in a contraction which lasted two minutes:

First minute,	First and second quarters, each, . .	18 pulsations.
	Third quarter, ...	20 "
	Last quarter, ...	22 "
Second minute,	First and second quarters, . . .	24 "
	Third quarter, ...	22 "
	Last quarter, ...	18 "

In proportion as the labor advances, the pulse accelerates the more; so that, a little while before delivery, it has the same frequency in the intervals as it had at first during the strongest contractions. We have already pointed out the modifications in the bellows murmur, noticed by the same observer during the pain, and shall not repeat them now, merely remarking, however, that they are sufficiently well marked to indicate the uterine contraction, even when the woman herself may be desirous of concealing it.

§ 2. Dilatation of the Os Uteri.

The fœtus evidently has no part in the dilatation of the os uteri until the bag of waters is ruptured. It is not until after this event takes place, that the vertex, by engaging like a wedge in the uterine neck, can hasten the dilatation mechanically; and it is equally evident that, in any other than a vertex position, the presenting part being more voluminous and irregular than the head, cannot perform the same office, and therefore, *cæteris paribus*, the orifice will open more slowly. Hence, it is not the fœtus, at least during the first part of the labor, which is the efficient cause, but here also the phenomenon is referable to the contraction of the uterine fibres.

Now, in order to understand how this occurs, we must remember, says Desormeaux, that the walls of the womb are applied to an ovoid body; that the longitudinal fibres are the most numerous, and that the circular fibres of the cervix, although capable of stoutly resisting their power, yet are gradually constrained to yield to the action of the longitudinal ones. If we now imagine these latter fibres to enter into contraction, we shall readily comprehend that, being unable to diminish the distended uterine cavity, all their power must be exerted in drawing upon those points of the circle which form the orifice, where each one is inserted, and thus remove them from the centre of the opening. Wherefore, every portion of the orifice being equally operated upon, it will present a circular form; but if the fœtus is placed transversely, and the womb dilated in that direction, the fibres being retracted more in the same diameter, the orifice will be elliptical.

The rapidity of the dilatation bears a direct ratio to the force and frequency of the contractions. In general, it is very slow in the commencement of labor, but much more rapid towards its close: for instance, if the opening dilated to the extent of one inch in four hours, it would only require two, or at most three hours for its complete enlargement; this progresses more slowly, however, in primiparæ than in other women. Again, the softness, or the rigidity and tension, of the neck during the intervals of pain, has a great influence over the rapidity of its dilatation; and the same may be said of the obliquity of the orifice; for when this latter is carried in front towards the pubis, or, what is still more frequent, is strongly directed backwards towards the sacrum — in either case, the neck is no longer placed in the axis of the contractions, and the head is forcibly pressed towards some part of the uterine wall, against which all the expulsive force is lost.

It is likewise important to bear in mind, that the posterior obliquity of the neck may be owing to an anterior inclination of the womb, and may also exist without the latter being at all changed from its normal position; this results from the head having been engaged a long time in the excava-

tion, and having pushed the anterior inferior uterine wall before it; the os uteri being at the same time carried upwards and backwards.

[When the orifice is directed very far backward, it is sometimes difficult to reach, and some practitioners make the mistake of supposing that the dilatation is completed even when the head is entirely covered by the anterior segment of the womb.[1]

This error is most liable to occur in first labors, for then the edges of the orifice are extremely thin, and when the head distends and presses down the lower segment of the uterus without interposition of the amniotic fluid, the sutures and fontanelles may be felt so easily as to lead to the supposition that the head is uncovered. A mistake of this nature may have serious consequences. I have myself seen attempts made to apply the forceps under these circumstances. To avoid misconception, the hips of the patient should be raised, the fingers passed very far back and moved over the contour of the head. If the orifice is really dilated, the finger will penetrate very deeply and pass alongside of the head without meeting any obstacle. If, however, dilatation has not been accomplished, the finger is soon arrested by the neck of the vaginal sac—especially in front.]

The orifice, which is generally very thin in primiparæ at the beginning of labor, becomes thicker towards the last half of the first stage; then it gets thinner, and finally forms a thick, rounded collar, which the head pushes before it as far as the inferior strait.

The reason of these various changes, says M. Guillemot, is very simple; for the pressure upon the neck acts more forcibly on the periphery of the orifice than on any other part, and the consequent thinning will disappear as soon as the uterine circle yields, and is carried back towards the parts that have not suffered an equal pressure, but have maintained their original thickness; though soon after, in consequence of fresh pains, the tension on this new circle will destroy its bulk and reduce it to the condition stated. Finally, a period arrives when the neck maintains its thickness, notwithstanding the dilatation it undergoes, because the uterine fibres, being excessively shortened, give more density to this part. I will add that the thickness of the anterior lip is often greatly augmented, when the engagement is far advanced, by œdema of the part, due to its compression between the head and the symphysis pubis; and further, that it is not at all uncommon to find the posterior lip quite thin, whilst the anterior one still remains considerably thickened.

§ 3. Of the Glairy Discharges.

We have already learned that an abundant secretion takes place in the vagina during the latter periods of gestation; but when the labor sets in, this secretion augments very considerably, and discharges of viscid mucus, resembling the white of an egg, designated as the glairy discharges, flow from the womb and vagina. In some women they become sanguinolent at the approach of the travail; but in others they are only so during labor. When blood is thus mixed with the other fluids, it is said to be an evidence that the dilatation of the orifice is advanced; this, however, is not always true, since, in some instances, several days elapse before the commencement of parturition. In some cases, indeed, they are wholly absent, and the labor

[1] Sometimes the orifice is so thin that the finger slips over it without perceiving it.

is then said to be a *dry one;* the genital parts experiencing a degree of heat and dryness almost akin to inflammation.

With regard to their origin, these discharges are not, as Ant. Petit and Baudelocque supposed, the product of a transudation of the amniotic waters through the pores in the membranes; but they simply result from the more abundant secretion of the mucous cryptæ in the neck and vagina; a secretion which is augmented by the greater irritation in those parts, caused by the labor. As to the blood that colors them, whether before or during the labor, it may come either from some slight laceration in the borders of the orifice, from a rupture of some of the minute vessels which run from the internal uterine surface to be distributed upon the membranes, or from the detachment of a small portion of the placenta; or, according to Desormeaux, it may escape from the extremities of the capillaries without any discoverable rupture.

These mucosities, commencing as we have before seen in the latter weeks of gestation, serve to lubricate the genital passages, and while relieving the vaginal walls and the parietes of the neck from their engorgement, they have the further advantage of moistening those parts, of softening the perineum and the vulvar orifice, and thus rendering the extreme distention which all of them must shortly undergo more easy. Their abundance is always to be considered a good sign, presaging a prompt dilatation and an easy expulsion.

§ 4. Of the Bag of Waters.

As the neck progressively dilates, the fœtal membranes present and become engaged therein, forming a tumor of variable size in the vagina, which is tense at the moment of contraction; and this is what is understood by the formation of the bag of waters. The sac varies in its shape with the figure represented by the uterine orifice; it is generally rounded and hemispherical, though ovoid when the cervix uteri dilates more in one diameter than another; when the membranes are formed of a loose, uncontracted tissue, and especially when they contain but a small quantity of liquid, they may form an elongated tumor in the vagina, without being a necessary sign of a presentation of either the hand or the foot, as some have incorrectly supposed.

We must acknowledge, however, that the bag of waters is usually less voluminous in vertex presentations than in others; and, consequently, that a very great protrusion of it nearly always announces an unfavorable position. This occasioned the remark of Madame Lachapelle: "I do not fear the flat sacs." As soon as the pain ceases the tumor disappears, the fluid that formed it re-enters the uterine cavity, and the flaccid, relaxed membranes hang in folds.

[The bag of waters, says Prof. Depaul, sometimes assumes another form which I have called the *double bag*, and is indicative of a twin pregnancy.

I first met with it whilst Interne at the Maternity Hospital in 1839, and was much puzzled by it, inasmuch as I had never met with any account of it and became aware of its significance only after the birth of the twins.

Some years after I met with the same thing at the lying-in hospital of the

Faculty, and remembering my former observation at the Maternity, did not hesitate to assert that there were two children, — which, in fact, were soon born. These are, however, the only cases which I have met with, nor ought their rarity to be a matter of surprise when we consider all the conditions required in order that two ovums, which are liable to assume such various positions in the cavity of the uterus should be equally forced upon the mouth of the womb by the contractions. Still it is well to record the fact in order that it may be made available upon occasion.]

FIG. 74.

The form of the bag of waters when the os uteri is fully dilated.

The formation of the sac is easily understood. The uterine cavity is gradually diminished, and the amniotic liquid, pressed on all sides, naturally flows towards the point that offers the least resistance, and such point is evidently the opening in the neck where no walls are found. The reason why so much difficulty existed in comprehending how the membranes could project into the vagina under the influence of this pressure of the liquid, was because the amniotic cavity was supposed to be distended to the utmost by the waters, and consequently that there must either exist a very great extensibility of the membranes, or else a transudation of the fluid through the walls of the ovum; but both hypotheses are false. For it is only necessary to press upon the abdomen of a pregnant woman to become satisfied that in most females a very slight pressure will be sufficient to flatten the ovum, whether in its vertical, transverse, or antero-posterior diameters. This is what takes place in labor, excepting that the ovum can only elongate below, on account of the uterine pressure upon all other parts, and thus produces the amniotic tumor.

When the dilatation is completed and the contraction energetic, the inferior part of the membranes, being no longer supported, soon yields to the impulse, and becomes ruptured, thereby permitting a variable quantity of liquid to escape. Where the pouch is voluminous, and gives way just at the moment of a strong pain, the rupture takes place with such a loud noise, that women in their first labor are often much alarmed, and then also the waters gush out in large quantity. But where the pouch is flat, and only a small quantity of fluid is interposed between the head and the membranes, the latter are lacerated without any noise, and but a little liquid oozes out after their rupture; because, the head by engaging at once in the os uteri obliterates it completely and blocks up the waters.

[When the membranes are ruptured, the following peculiarities may be observed in the discharge of the amniotic fluid. At the beginning of each contraction, it is forced toward the lower segment of the uterus and a small quantity is discharged from the vulva. At the height of the contraction the flow is arrested, because the direct application of the head against the orifice stops it completely. Finally, when the contraction subsides, the head will close the orifice imperfectly and allow a fresh quantity to escape externally.]

In the vast majority of cases, the membranes are lacerated on that portion

of the bag corresponding to the uterine orifice. But sometimes the rupture occurs much higher up; and this fact, which is almost inexplicable in the present state of our knowledge, should nevertheless be known, because it accounts for the circumstance of the inferior segment of the ovum being then found intact after the discharge of a certain quantity of water, and of our having to puncture the membranes subsequently in this part. Sometimes they are ruptured in the beginning of the labor, which is thereby usually rendered longer and more difficult for the mother, as also more dangerous for the child, especially when a considerable quantity of water escapes at the same time. Besides these varieties, I have several times noticed a remarkable peculiarity that seems to have escaped the attention of practitioners generally; I allude to the occurrence of a rupture before any contraction of the uterus whatever. This constitutes in a few females the first phenomenon of the labor; but the pains do not come on for some time afterwards, occasionally not for several days. Now, this premature laceration has seemed to me to be coincident with a presentation of the vertex that is deeply engaged in the excavation; for although the patient felt no previous pain, and even in certain cases was sleeping profoundly when the waters escaped, it is highly probable that the uterus had already been contracting for some time, and the occurrence may be referred to those non-painful contractions hitherto described; unless, perhaps, it may possibly depend on an excessive distention of the amniotic pouch.

Sometimes the membranes are very hard, thick, and resistant, the rupture only taking place at an advanced stage of the labor, when the head clears the vulva, for instance; or it may occur in a circular manner, and the head escape covered by a kind of hood. The child is then said to be born with a *caul*, and the vulgar, from that circumstance, prophesy a *happy future*.

The infant may also be born hooded, when a rupture of the membranes first occurs at an elevated point, one not corresponding at all with the uterine neck; and should the head then push before it a portion of the amniotic pouch, serious accidents might result in consequence: for instance, this late rupture might delay the labor, or the tension experienced by the membranes, extending to the placenta, may cause its premature detachment, especially when it is inserted on the sides of the organ, and thus produce a uterine hemorrhage.

In ordinary cases, the rupture takes place at the commencement of the second stage.

The subjoined is a statistical summary made by Churchill, at the Western Lying-in Hospital, during the years 1841 and 1842, which will enable the reader to judge of the varieties that may be met with.

The period elapsing between the commencement of the labor and the rupture of the membranes has been noted in 984 cases. Thus:

In 167	females,	this time was			2	hours.
" 335	"	"	from 2	to	6	"
" 165	"	"	" 6	"	10	"
" 113	"	"	" 10	"	14	"
" 71	"	"	" 14	"	18	"
" 33	"	"	" 18	"	22	"
" 46	"	"	" 22	"	26	"

In	23	females	this time	was from	26	"	30 hours.
"	8	"	"	"	30	"	38 "
"	9	"	"	"	38	"	40 "
"	4	"	"	about		50	"
"	2	"	"	"		60	"
"	4	"	"	"		70	"
"	3	"	"	"		80	"
"	1	female	"	"		105	"
	984						

The same observer noted the time from the rupture of the membranes until the child's birth in 812 cases.

In	396	women,	this time was	1	hour
"	142	"	"	2	hours.
"	120	"	"	4	"
"	50	"	"	6	"
"	34	"	"	8	"
"	17	"	"	10	"
"	26	"	"	15	"
"	11	"	"	20	"
"	3	"	"	28	"
"	4	"	"	35	"
"	1	woman	"	40	"
"	1	"	"	50	"
"	1	"	"	150	"
	812				

§ 5. Of the Duration of Labor.

The duration of labor is exceedingly variable, even when no obstacle opposes its natural course. Some women are delivered in an hour or two, whilst others are not for several days; and between these two extremes, there is every intermediate grade.

The published statistics are hardly reliable, for most of them have been collected in hospitals; and it is a fact, that the majority of women, dreading to be taken into the apartment devoted to the patients in labor, conceal their first pains, and give up only when they can restrain themselves no longer. Therefore, when interrogated after delivery, their statements are not found to coincide with their record, and make their labor appear much longer than the latter would indicate. This correction seems to me of importance, for most physicians of limited experience, having learned that the duration of labor is from five to six hours, are apt to become alarmed unnecessarily when they find it continuing even longer than from ten to twelve hours.

In general, it is longer in primiparæ than in others; and this difference is chiefly owing to the resistance of the perineal muscles, which is much greater in the former, though it is also influenced by the dilatation of the neck, which is effected in them very slowly.

The whole length of their labor is usually from ten to twelve hours, but it should be known that, in at least one case in five, it may not terminate under fifteen, eighteen, or even twenty hours, and this without any injury

whatever resulting either to the mother or the child. Women who have had children are delivered much sooner, only suffering, in ordinary cases, about six or eight hours. According to Alph. Leroy and Velpeau, the pains are apt to observe periods of six hours: that is, the labor lasts either six, twelve, eighteen, twenty-four, or thirty hours. I think, if their observation be correct, it will be found subject to very numerous exceptions.

But, supposing the labor has really commenced, can we predict the hour of its termination with any degree of certainty? This question, which is nearly always addressed to the accoucheur, is oftentimes a very difficult one to answer, for habit alone can enable us to judge by the dilatation, or the suppleness of the neck; by its tension, its hardness, and resistance; by the frequency and intensity of the pains; by the time it has already existed, and by the greater or less resistance of the vulva and perineum, of the probable length of the labor.

It must also be remembered, in regard to the duration, that the first stage of labor is to the second, as two, or even three, to one; and, further, this difference is still more marked in women who have had children, than in primiparæ; and that the first half of the dilatation of the neck is much slower than the second. But how many exceptions are there to this law! For instance, the dilatation is sometimes regular, and sufficiently rapid, everything seeming to promise an easy and prompt termination; yet all at once the pains become feeble and languishing, and our art is often obliged to interpose in aid of the uterine contractions; while, on the contrary, it not unfrequently happens that the neck is expanded with an excessive degree of slowness, after which, a few moments will suffice to effect the delivery.

The form of the vagina, according to Wigand, should also be taken into consideration, in making a prognosis as to the probable duration of the labor: thus, if this canal is large throughout, the whole time will be short; and, on the other hand, the dilatation of the cervix, and the expulsion of the child will be very slow, should the vaginal cavity be regularly contracted throughout its extent; again, if the vulvo-uterine canal is large and spacious superiorly, but contracted and unyielding near the external orifice, the first part of the labor will be prompt, but the last slow and difficult; and, finally (though more rarely), if its upper extremity is very narrow, the inferior being at the same time largely dilated, we may conclude that the parturition will progress slowly at first, but will then terminate speedily.

It is a very singular fact, that an hereditary influence is sometimes manifested in the process, it being not at all uncommon to find the same peculiarities transmitted through three or four successive generations; the mother, the daughter, and the granddaughters being remarkable either for the slowness or rapidity of their labors.

In general, it is impossible to predict with any degree of certainty the hour of its termination; yet most people seem to imagine that the physician is bound to give the most particular information on this point. He must, however, always be very guarded in his replies, for should the labor overrun the fixed time by some hours, it would give rise to the most anxious solicitude, and it is therefore prudent not to be too precise. When such

questions are addressed to me, I am in the habit of saying, that, if the contractions are regular, and no accident occurs, if, in a word, all things go on right, the delivery will take place at the hour I name.

In fact, it is absolutely impossible to foresee all that may happen; because, in certain cases, the dilatation of the os uteri, which, perhaps, only amounted to one inch, after five or six hours of labor, is suddenly completed; and, at other times, this process being very little advanced, the margin of the orifice is lacerated under the influence of a strong pain, and the delivery effected, perhaps, just as the physician has announced that the labor will still last for several hours. In examining a young woman, pregnant for the first time, I found the orifice dilated to the size of a quarter of a dollar, and, supposing that the labor would last for some time, I withdrew, but scarcely had I reached the foot of the staircase, when a messenger came running after me in great haste; I immediately returned, and found the head on the point of clearing the vulva, which was already considerably opened. After the labor was over, I ascertained that the whole left side of the vaginal portion of the neck had been lacerated.

A young primiparous female experienced the first pains at four o'clock in the morning. Throughout the day the contractions were very feeble, with intervals varying from a quarter of an hour to an hour. The dilatation was so slow, that at four o'clock in the afternoon the orifice had barely attained the size of a dime. After five o'clock, the pains were rather stronger and quicker; at nine P. M., the neck was very thin, and presented an opening of three-quarters of an inch in diameter. Being obliged to leave the patient for an hour, I thought I might do so with safety, but immediately after my departure the contractions became powerful, and at a quarter before ten, she gave birth to a very small child, which barely weighed five pounds. The small size of the fœtus accounts for the rapidity of the labor; and yet this lady had enjoyed good health during her pregnancy, besides having reached her full term.

The woman's age has not the unfavorable influence upon the duration of labor, even in primiparæ, which is accorded to it by some authors. "There has always," says Madame Lachapelle, "been an opinion prevalent on this point which I can by no means adopt; it is, that the dilatation of the passages is more difficult in women advanced in years than in others, and there is not an accoucheur who does not dread the first labor in a female of thirty or thirty-five years of age; nor is there a woman in that condition who does not anticipate with terror the hour of her delivery. My experience has, however, so often proved the fallacy of such prejudices that I cannot adopt them.

"No doubt, the labor is often slow and painful in middle-aged women who have had no children, yet the same is the case with the youngest. I dare affirm, indeed, that there is no more difficulty in the one case than in the other, and that if four young primiparous females out of ten have easy labors, four out of ten of the oldest will also be delivered with promptitude and facility."

§ 6. Of the Effect of Labor upon the Mother and Child.

A. *Effect of the Labor upon the Mother.*—Independently of the numerous accidents which are liable to occur, and which will be studied hereafter under the head of *Causes of Dystocia*, the parturient process has a decided effect upon the physical and moral condition of the female, which, unfortunately, almost uniformly escapes attention. This effect may be exhibited in both the first and second stages, and even continue for a few hours or days after delivery.

The commencement of labor is preceded in many females by a state of anxiety and prostration, and often by feelings of fear and disquietude. This usually ceases after the first pains are experienced, all the powers of the organism seeming then to be devoted to the accomplishment of the great function about to be performed. All others are modified or suspended, the appetite is lost, and if the patients have eaten shortly before, they not unfrequently reject all that has been taken by vomiting. If much time be occupied by the process of dilatation, they weep, and become irritable and despairing.

This excitability diminishes as soon as the second stage commences, and the patient begins to feel that her *labor* has really begun. From that time her attention seems concentrated on a single object, and she is indifferent to everything else. During the expulsive pains, her condition approaches that which characterizes inflammation or fever; thus, the circulation is quickened in a degree which seems connected with the force of the contractions; the heat and moisture are sensibly augmented, and the red and even livid features sometimes covered with profuse perspiration; again, in some cases the skin may be dry and hot.

The intensity of the pains occasionally throws the patient into a state of extreme agitation, and so disorders her faculties that she commits acts of violence upon her attendants.

This agitation, which is very moderate when the labor progresses regularly, becomes extreme when the latter is retarded or prolonged inordinately. The beginning of each pain is then marked by an almost convulsive trembling of the extremities. The face is burning, and the entire body bathed in perspiration, the eye is fixed and haggard, and the features changed; the unfortunate sufferer screams, laments, desires to die, and begs to be either killed or relieved of her agony. The well-marked disorder of the intellectual faculties is sometimes carried to complete delirium, during which the patients utter the most extravagant expressions. Two such cases have come under my own observation. The delirium is almost always preceded and accompanied by great loquacity, and the pains are hardly felt. I knew a young lady, after a rather lengthy labor attended with extreme suffering, suddenly to cease complaining, assume a smiling expression, and after a few incoherent phrases, to sing in full voice the grand air of *Lucia di Lammermoor*. I cannot express the terrifying effect produced by this song upon myself and the attendants. (A bleeding, followed by the immediate application of the forceps, had the effect of calming the patient, and there was no recurrence of delirium.) Montgomery also states, that he has known women to be completely delirious for a few moments, just as the head was escaping from the mouth of the womb.

These great disturbances of the economy are not confined to cases of very tedious labor, for the same symptoms have been witnessed in very short ones with powerful and very rapid pains. The cerebral excitement which their violence produces, may be carried even to the point of insanity; so that medico-legal jurists have accounted for infanticides by this momentary disorder of the intellect, which would otherwise have been inexplicable.

The disorder is sometimes confined to the affective faculties. I have seen a mother, says Ed. Rigby, after a very short and painful labor, exhibit an unconquerable aversion to her child, and express herself in reference to it in terms which contrasted strangely with the tender and affectionate remarks which she had uttered but a few moments previously.

These disorders of the intellectual and affective faculties generally last but a short time, and are not significant of great danger; sometimes, however, the shock to the system is so great, that death takes place suddenly, either during the course of the labor, or shortly after delivery. A poor woman, in the Charity Hospital, says Davis, had been in labor for five hours; the membranes ruptured, and a large amount of water escaped; the discharge was immediately followed by a feeling of great weakness; having a desire to go to stool, she sat down upon a chamber, made a few efforts, and fell fainting. She was placed in the horizontal position as soon as possible, but had hardly been replaced in bed before she had ceased to live. The autopsy revealed nothing which would account for the death. Denman also mentions several cases of sudden death during labor, which it was impossible to explain.

In some of these instances, however, the sudden discharge of a large amount of water might, to a certain extent, lead us to attribute the mortal syncope to the same cause which is thought to produce it so often after delivery: namely, the sudden afflux of a great quantity of blood to the abdominal vessels, which had been suddenly relieved from the pressure to which they were subjected during pregnancy.

An undue importance has, I think, been attributed to this too rapid depletion of the organ as explanatory of sudden death after labor. In some instances, it may have all the influence accorded to it, though it is certainly incapable of accounting for all known facts.

The violent efforts made by the woman in the second stage of labor may also occasion a rupture of some part of the respiratory organs. This explains the cases of emphysema of the face, neck, and upper part of the breast, mentioned by several authors (Martin, of Lyons). In a serious case related by M. Depaul, death resulted apparently from double pulmonary emphysema occurring suddenly during the violent expulsive efforts of a long and painful labor.

The fatal effect of the process of parturition upon the nervous system of the mother, after as well as during labor, cannot be mistaken; and I believe with Churchill that it consists in a shock of greater or less intensity to the cerebro-spinal system. This shock, which is an effect of the extraordinary agitation produced by parturition, is altogether similar to that occasioned by extensive wounds, and which sometimes destroys unfortunate workmen who have had a member crushed by a machine, or to that produced by an

extensive burn. The sudden death, which neither the circumstances of the accident, nor the lesions discovered at the autopsy are capable of explaining, is attributed by surgeons to nervous shock.

Not only, says the author just cited, may such a nervous shock take place in certain labors, especially difficult ones, and have a disastrous result, but it exists to a greater or less extent in almost every case. Moderate attention will make this manifest. Thus, after an ordinary labor, the general sensibility is almost always extreme: although the senses are more acute than usual, the eyes have lost their lustre, and are weak and languishing; the least light hurts them, as the slightest sound offends the ear; and if this extreme delicacy be not respected, serious accidents may ensue.

Under ordinary circumstances, patients recover from this slight collapse after a few hours' rest; but when the labor has been protracted, or an operation, such as turning, has been demanded, the symptoms are much more severe. The patient is much weaker, and the expression of features is fixed and dull; she lies motionless in bed, with closed eyes, or opens them from time to time, without, however, fixing them upon any object in particular; she pays no regard either to her child or to herself; the limbs are in a state of complete relaxation; the pulse is sometimes slow, at others frequent and irregular, though always weaker than usual, and the breathing slow and difficult, or quick and panting.

The patient may remain in this condition for a long time, and recovers from it slowly and gradually. If the shock has been too great, she may grow weaker and weaker, until the prostration ends in death. The autopsy, under these circumstances, fails to throw any light upon the cause of death.

This singular state of affairs is not always manifested immediately upon delivery; for sometimes considerable time elapses, during which the patient expresses herself as feeling very well, then suddenly complains of unusual weakness, exclaims that she is about to faint, and yet is unable to account for the cause of her condition. There are no particular abdominal symptoms, no evidence of hemorrhage, and the uterus is well contracted; still the disorder increases, the pulse grows weaker, the face becomes pale and assumes a cadaverous expression, and the patient is so prostrated as to be able to express her feelings only by a groan. Suddenly she experiences a sensation of violent constriction of the chest, and expires before anything can be done for her relief.

Opium, says Churchill, has seemed to me the most effectual remedy in these cases. Five drops of laudanum may be given every half hour, then every hour, and finally at longer intervals. It appears to calm the general disturbance, diminish the cerebral shock, and give to the whole system sufficient time to recover its exhausted forces. Small quanties of wine and brandy may, at the same time, be given at intervals, in doses sufficient to assist in re-establishing the strength, but not in such quantity as to produce a general reaction. The induction of sleep will be assisted by entire quietness of both body and mind, and when so fortunate a result is obtained, the strength is recruited, and the pulse and respiration become calm; if, on the contrary, the prostration continues, the case is one of the most dangerous character, and demands the increased use of external and internal stim-

ulants. Ramsbotham recommends that pressure should also be made upon the abdomen, doubtless with the object of preventing the afflux of fluids towards the abdominal vessels.

If the agitation, spasm, and delirium, of which we have spoken, appear during labor, blood should be taken immediately from the arm, provided the general condition of the patient admit of it, and the delivery be accomplished as soon as possible.

The same course is also indicated by the sudden occurrence of a marked disorder of one of the organs of the special senses,—amaurosis, for example.

B. *The effect which labor may have upon the fœtus* depends upon a multitude of circumstances, most of which will be studied hereafter. Thus, having described the mechanism of labor in each presentation, we shall treat of the effect which each is liable to have upon the health and life of the child. The various causes of dystocia are quite as unfavorable to the latter as to its mother.

We have but these observations to make in this place; namely, that all things else being equal, the mortality of male infants is much greater than that of females, which is due, as we have said before, to the greater size of the former, and the proportionally longer duration of the labor in consequence; the extreme slowness of this process, which so often proves fatal to the fœtus, has this unfortunate effect only when it affects the second or expulsive stage. Until the membranes are ruptured, and even until the dilatation is completed, the labor may be prolonged indefinitely without injury to the fœtus, provided a certain amount of fluid remains in the uterus.

It were hardly necessary to observe that any cause of dystocia is liable to affect the mother's health injuriously, and she is more liable to consecutive inflammations and other unfavorable complications of labor when delivered of a boy than of a girl.

CHAPTER III.

OF THE MECHANICAL PHENOMENA OF LABOR.

ARTICLE I.

OF THE PRESENTATIONS AND POSITIONS.

When speaking of the child's attitude in the uterine cavity, we stated that it was generally so situated that the cephalic extremity formed the most dependent part. But it may also happen, under the influence of causes hereafter to be studied, that some other point of the great axis shall correspond to the uterine neck: that is to say, the upper or cephalic extremity, the inferior or the pelvic extremity, or even some part of the middle portion or trunk, may first present itself at the superior strait. Now, it is very evident that such different circumstances of presentation must necessarily influence the mechanism of the labor, as also the facility and the promptness of the delivery, and it is therefore highly important to understand well all those diverse situations before commencing the study of the mechanism proper. This study comprises the presentations and positions, as they are called; and in using these terms we wish to designate by the word *presentation* the part that first offers at the superior strait; and by that of *position*, the relations of this presenting part with the different points of the same strait.

The older accoucheurs only endeavored to recognize the presenting part, without investigating its relations with the various points of the circumference of the strait; but since the days of Solayres, and more especially since those of his pupil Baudelocque, everybody has had a classification of his own; and the number of presentations and positions, considered as so many separate and distinct ones, varied with each author who wrote on the obstetrical art.

We give, in the following tables, the classification of Baudelocque, and the principal ones of those who have succeeded him.

GENERAL TABLE OF THE CLASSIFICATIONS.

NAMES OF AUTHORS.	PRESENTATION.	RELATIONS OF THE FŒTAL PARTS WITH VARIOUS POINTS OF THE PELVIS.	NAMES OF THE POSITIONS.
BAUDELOCQUE, . . .	VERTEX OR SUMMIT, . .	Occiput at the left acetabulum, ...	1st. Left occipito-cotyloid.
		Occiput at the right acetabulum, ...	2d. Right " "
		Occiput at the symphysis pubis, ...	3d. Occipito-pubic.
		Occiput at the right sacro-iliac symphysis, . . .	4th. Right occipito-sacro-iliac.
		Occiput at the left sacro-iliac symphysis, . . .	5th. Left occipito-sacro-iliac.
		Occiput at the sacro-vertebral angle, ...	6th. Occipito-sacral.
	FACE, ...	Chin at the symphysis pubis, ...	1st. Mento-pubic.
		Chin at the sacro-vertebral angle, ...	2d. Mento-sacral.
		Chin directly to the right, ...	3d. Right mento-iliac.
		Chin directly to the left, ...	4th. Left mento-iliac.
	FEET, ...	Heels at the left acetabulum, ...	1st. Left calcaneo-cotyloid.
		Heels at the right acetabulum, ...	2d. Right calcaneo-cotyloid.
		Heels at the symphysis pubis, ...	3d. Calcaneo-pubic.
		Heels at the sacro-vertebral angle, ...	4th. Calcaneo-sacral.
	KNEES, ...	Front of the tibias at the left acetabulum, . . .	1st. Left tibio-cotyloid.
		" " at the right acetabulum, . .	2d. Right tibio-cotyloid.
		" " at the symphysis pubis, . . .	3d. Tibio-pubic.
		" " at the sacro-vertebral angle, .	4th. Tibio-sacral.
	BREECH, ...	The sacrum at the left cotyloid cavity, ...	1st. Left sacro-cotyloid.
		The sacrum at the right cotyloid cavity, ...	2d. Right sacro-cotyloid.
		The sacrum at the symphysis pubis, ...	3d. Sacro-pubic.
		The sacrum at the sacro-vertebral angle, . . .	4th. Sacro, or lumbo-sacral.

NAMES OF AUTHORS.	PRESENTATION.	RELATIONS OF THE FŒTAL PARTS WITH VARIOUS POINTS OF THE PELVIS.		NAMES OF THE POSITIONS.
BAUDELOCQUE, .	TRUNK, ...	Occiput, . . .	Four positions for each of these presentations, viz.:	
		Neck, ...		
		Back, ...		
		Loins, ...		
		Face, ...		
		Front of neck, .		
		Breast, . . .		
		Abdomen, . .	Head above the pubis, ...	1st. Cephalo-pubic.
		Front of pelvis,	Head above the sacro-vertebral angle,	2d. Cephalo-sacral.
		" of thighs,	Head to the left, ...	3d. Left cephalo-iliac.
		Side of the head,	Head to the right, ...	4th. Right cephalo-iliac.
		" of neck, .		
		Shoulder, . .		
		Side of thorax,		
		Flank, . . .		
		Hip, ...		
GARDIEN, . . .	VERTEX, ...	Six positions, the same as Baudelocque, ...		Same denomination as Baudelocque.
	FACE, ...	Four positions, the same as Baudelocque, ...		" " "
	FEET, ...	Four positions, the same as Baudelocque, ...		" " "
	KNEES, ...			
	BREECH, ...			
	TRUNK, ...	Four positions for each of these, viz.:		
		Right side, . .	Head to the left, ...	1st. Left cephalo-iliac.
		Left side, . .	Head to the right, ...	2d. Right cephalo-iliac.
		Anterior plane,	Head in front, ...	3d. Cephalo-pubic.
		Posterior plane,	Head behind, ...	4th. Cephalo-sacral.
CAPURON, . . .	VERTEX, ...	Occiput at the left acetabulum, ...		1st. Left occipito-cotyloid.
		Occiput at the right acetabulum, ...		2d. Right occipito-cotyloid.
		Occiput at the right sacro-iliac symphysis, ...		3d. Right occipito-sacro-iliac.
		Occiput at the left sacro-iliac symphysis, ...		4th. Left occipito-sacro-iliac.
	FACE, ...	Chin at the left acetabulum, ...		1st. Left mento-cotyloid.
		Chin at the right acetabulum, ...		2d. Right mento-cotyloid.
		Chin at the right sacro-iliac symphysis, ...		3d. Right mento-sacro-iliac.
		Chin at the left sacro-iliac symphysis, ...		4th. Left mento-sacro-iliac.

CAPURON,	FEET, KNEES, BREECH.	Four positions for each of these three presentations, according as the heels, the anterior tibial surfaces, or the posterior face of the sacrum correspond to the—	
		Left acetabulum,	First position.
		Right acetabulum,	Second "
		Right sacro-iliac symphysis,	Third "
		Left sacro-iliac symphysis,	Fourth "
	TRUNK,	Right side, Left side, Anterior plane, Posterior plane, — In each of these four the head may be found above the—	
		Left acetabulum,	1st. Left cephalo-cotyloid.
		Right acetabulum,	2d. Right cephalo-cotyloid
		Right sacro-iliac symphysis,	3d. Right cephalo-sacro-iliac.
		Left sacro-iliac symphysis,	4th. Left cephalo-sacro-iliac.
LACHAPELLE,	VERTEX,	Occiput at the left acetabulum,	1st. Left occipito-cotyloid.
		Occiput at the right acetabulum,	2d. Right occipito-cotyloid.
		Occiput at the right sacro-iliac symphysis,	3d. Right occipito-sacro-iliac.
		Occiput at the left sacro-iliac symphysis,	4th. Left occipito-sacro-iliac.
		Occiput directly to the left,	5th. Left occipito-transverse.
		Occiput directly to the right,	6th. Right occipito-transverse.
	FACE,	Chin directly to the right,	1st. Right mento-iliac.
		Chin directly to the left,	2d. Left mento-iliac.
	PELVIC EXTREMITY,	Loins to the left,	1st. Left lumbo-iliac.
		Loins to the right,	2d. Right lumbo-iliac.
		Loins in front,	3d. Lumbo-pubic.
		Loins behind,	4th. Lumbo-sacral.
	TRUNK,	Right side, — Head left,	1st. Left cephalo-iliac.
		Right side, — Head right,	2d. Right cephalo-iliac.
		Left side, — Head left,	1st. Left cephalo-iliac.
		Left side, — Head right,	2d. Right cephalo-iliac.
VELPEAU,	VERTEX,	Like Baudelocque,	Same as Baudelocque.
	FACE,	Like Lachapelle,	Same as Lachapelle.
	FEET, KNEES, BREECH,	As many positions for each of these three presentations as for the vertex.	The same corresponding denominations for each of the six positions.
	TRUNK,	Right side, Left side, Posterior plane, Anterior plane, — Two positions for each of these, viz.:	
		Head to the left,	1st. Left cephalo-iliac.
		Head to the right,	2d. Right cephalo-iliac.

CLASSIFICATION OF PROFESSOR MOREAU.

TWO CLASSES. { NATURAL LABORS. / ARTIFICIAL LABORS.

FIRST CLASS.—Natural Labors.

- **FIRST ORDER.** Presentation of the cephalic extremity.
  - 1st genus. Vertex presentation.
    - 1st position.—Left occipito-ilium. { anterior, transverse, posterior.
    - 2d position.—Right occipito-ilium. { anterior, transverse, posterior.
    - 3d position.—Occipito-pubic.
    - 4th position.—Occipito-sacral.
  - 2d genus. Face presentation.
    - 1st position.—Right mento-ilium. { anterior, transverse, posterior.
    - 2d position.—Left mento-ilium. { anterior, transverse, posterior.
  - 3d genus. Presentation of the sides of the head. 2 subdivisions.
    - Right side.
      - 1st position.—Lobulo-pubic.
      - 2d position.—Left lobulo-ilium.
      - 3d position.—Right lobulo-ilium.
    - Left side.
      - 1st position.—Lobulo-pubic.
      - 2d position.—Left lobulo-ilium.
      - 3d position.—Right lobulo-ilium.
- **SECOND ORDER.** Presentation of the pelvic extremity.
  - 1st genus. Breech presentation.
    - 1st position.—Left sacro-ilium. { anterior, transverse, posterior.
    - 2d position.—Right sacro-ilium. { anterior, transverse, posterior.
    - 3d position.—Sacro-pubic.
    - 4th position.—Sacro-sacral.
  - 2d genus. Foot presentation.
    - 1st position.—Left calcaneo-ilium.
    - 2d position.—Right calcaneo-ilium.
    - 3d position.—Calcaneo-pubic.
    - 4th position.—Calcaneo-sacral.
  - 3d genus. Presentation of the knees.
    - 1st position.—Left tibio-ilium.
    - 2d position.—Right tibio-ilium.
    - 3d position.—Tibio-pubic.
    - 4th position.—Tibio-sacral.
- **THIRD ORDER.** Accidental natural labor.
  - Single genus.—Presentation of the trunk. (See below.)

SECOND CLASS.—Artificial Labors.

- **FIRST ORDER.** Accidental artificial labor.
  - 1st genus. Accidents on the mother's part.
  - 2d genus. Accidents on the part of the fœtus.
- **SECOND ORDER.** Essentially artificial labor.
  - Single genus. Presentation of the trunk. 2 subdivisions.
    - 1st. Right side. . .
      - 1st position.—Left cephalo-ilium.
      - 2d position.—Right cephalo-ilium.
    - 2d. Left side. . .
      - 1st position.—Left cephalo-ilium.
      - 2d position.—Right cephalo-ilium
- **THIRD ORDER.** Labors which are the result of malformation.
  - 1st genus. On the part of the child.
  - 2d genus. On the part of the mother.

APPENDIX, OR THIRD CLASS.—Anomalies.

Anomalies either in the seat, course, or products of gestation, or lesions of the womb.

The reader will see, by the foregoing table, that Baudelocque primarily divides the fœtus into two extremities: the one represented by the apex of the head, the other by the feet, knees, or breech; and further, that the remainder of the child's surface is divided off into four regions, which are again subdivided into several others. After having determined the fœtal regions, the presence of which, at the superior strait, constituted a presentation, it was equally necessary to understand the positions. For that purpose certain points of departure were selected, both on the pelvis and on the presenting part of the child. Of course, these points varied according to the presentation: thus, in a vertex one, Baudelocque took the occiput and forehead as the points on the fœtal head; he then divided the pelvis into an anterior and a posterior half; on the first of which the right and the left cotyloid cavities and the symphysis pubis, and on the second the right and left sacro-iliac symphyses, and the sacro-vertebral angle, were selected as the points of departure; he next established six positions of the vertex, in each of which the occiput corresponded to one of those points on the pelvis just indicated.

In the presentations of the breech, knees, and feet, he retained the same three points on the anterior half of the pelvis, but on the posterior half he only adopted one: the sacro-vertebral angle. On the fœtus, the heels were the points of correspondence in foot presentations, the sacrum for the breech, and the front surface of the legs for those of the knee. Consequently, but four positions were admitted for either the breech, feet, or knees.

Lastly, for the presentations of the numerous regions indicated by the table on the anterior, posterior, and lateral planes of the fœtus, he selected on the mother's pelvis the two extremities of the antero-posterior diameter (the symphysis pubis and the sacro-vertebral angle), and the two ends of the transverse diameter, as the points of departure, so that he pointed out four possible relations, that is to say, four positions for each one of these presentations. Thus, Baudelocque admitted altogether one hundred and two distinct positions. But it was soon ascertained that so great a number was wholly useless in practice: and besides, it had the serious disadvantage of disgusting pupils with the study of midwifery. The classification of Baudelocque was therefore modified to some extent, and we have successively traced, in our table, the principal of those modifications; still, even after adopting the latter, the obstetrical art was yet greatly confused, and it remained for M. Nægèle to simplify this branch of medical science, much more than it had ever been done before his day. To him, therefore, we must attribute this honor, as also to Dubois, and Stoltz, of Strasbourg, who first endeavored to disseminate throughout France the views of the Heidelberg professor! It must be acknowledged, however, that the labors of Madame Lachapelle, and the teachings of Ant. Dubois, have not been altogether foreign to this improvement.

We should also observe that the classification of M. Moreau is far more simple than all those of Baudelocque and his followers; indeed, this professor has adopted (as seen by the table) most of the ideas upon which the arrangement of Nægèle is founded, and we only regret that he has considered the presentations of the sides of the head and certain of the positions

as distinct, which we hope to demonstrate hereafter do not deserve to be so regarded.

In fact, there is no region of the child which may not present at the superior strait during the labor, and therefore, if we are to consider all the points of its surface that may be accessible to the finger as so many distinct presentations, their number would be very considerable; but if, on the contrary, the expression is only applied to the presence of a region large enough to occupy the whole superior strait, more especially to one requiring a notable difference either in the mechanism of its spontaneous expulsion, or in the manœuvres to be resorted to, this number would then be much more limited.

Upon such opinions, advocated long since by Madame Lachapelle and Ant. Dubois, M. Nægèle has founded the following classification, which is now admitted and taught by Dubois and Stoltz in France, namely, three principal regions are distinguished in the fœtus: 1. The head, or cephalic extremity; 2. The pelvis, or pelvic extremity; and 3. The trunk; either of which parts may offer first at the superior strait.

When the cephalic extremity presents, it is ordinarily flexed on the chest, and the vertex then advances first; but it may also be extended or thrown backwards on the posterior plane of the fœtus, in which case the face engages first. We have therefore to distinguish between a vertex presentation and one of the face, for the mechanism of labor is very different in the two. When the pelvic extremity presents, the legs are usually flexed on the thighs, and the latter on the abdomen; but it may happen, from a variety of causes that we shall hereafter designate, that these divers parts, which are usually folded up in this manner, are separated from each other: thus, they sometimes engage altogether in the excavation; at others, either during the course of the labor itself, or some time before, the inferior members stretch out and lay along the front of the body, and the nates then descend alone. Again, the legs may be swept down either by the gush of the waters, or by some other cause, and engage first; hence, in this latter instance, if the deflexion of the lower members is complete, the feet are the first to clear the vulva; but if, on the contrary, the thighs be extended, and the legs remain flexed on them, the knees will be the first to show themselves at the external orifice.

Now it must be evident, on the least reflection, that these latter circumstances can effect no modification in the mechanism of the labor itself, and accoucheurs are certainly in error in considering them as so many distinct presentations; consequently, we shall describe them under the single title of the presentation of the pelvic extremity; merely remarking that, when this extremity presents, all its constituent elements may happen to engage together at the same time, or they may be separated, and then the breech, or the knees, or feet, will offer first at the vulva.

But before proceeding any further, we will follow the example of M. Dubois (from whom this article is borrowed almost verbatim), by laying down precisely the limits of the fœtal regions embraced in the double expression of the cephalic and the pelvic extremity: thus, when the head or the pelvis presents at the superior strait, it usually does so nearly "plumb:"

that is to say, the long diameter of the fœtus is almost parallel to the axis of this strait; so that the sagittal suture in the vertex presentations, the facial median line in those of the face, and the fissure between the nates in those of the pelvic extremity, occupy very nearly the centre of the abdominal strait.

But very numerous exceptions to this rule occur, because the mobility of the fœtus in the uterine cavity, and the frequency of the uterine obliquities, may cause the child's long diameter to be inclined forwards, backwards, or towards the sides. Hence, it is evident that the presenting part, participating in this inclination, will not be so regularly placed as usual; thus, if it were a vertex presentation, and the inclination were anterior, the summit would no doubt descend, though it would be accompanied by the forehead in consequence of this defective position; or, if the inclination were on the posterior plane, instead of the forehead, we should have the occiput or occasionally even the neck. Again, if it is lateral, that is, if the fœtus is bent towards one side, the vertex and one side of the head may be recognized at the same time; and the sagittal suture, instead of corresponding to the axis of the superior strait, will then be found either behind or in front, according to the direction of the inclination; but such inclinations do not deprive the vertex presentation of its character, they only convert it into a defective or irregular presentation.

The observations just made in regard to vertex presentations equally apply to those of the face and breech, and we may therefore have regular and irregular ones of these parts just in the same way. To resume, we shall include in the class of vertex presentations, all those designated by Baudelocque under the names of presentations of the occiput, nape, and lateral parts of the head; in face presentations, those of the forehead, chin, cheeks, front and sides of the neck; and in the breech, those of the sacrum, genital parts, front of the thighs, &c.; whence all the surface comprised between the sinciput and the shoulders belongs to the cephalic presentations, and that between the summit of the nates and the haunches is referred to the pelvic ones.

If we now take off all the fœtal parts included in the cephalic and pelvic extremities, there will only remain the trunk proper: that is, the portion extending from the shoulders to the hips, and this part may also present the first. Now with regard to this, Madame Lachapelle has long since remarked that, when the trunk offers at the superior strait, it always does so by one of its sides: that is to say, the anterior or the posterior median line of the body never corresponds to the axis of the superior strait. Therefore, she divided the trunk into two lateral halves, either of which may come down first; hence there are two trunk presentations, one of the right lateral plane, the other of the left lateral plane; the whole anterior and posterior right moieties being included in the first, and the same parts on the left being embraced in the second; and as the shoulder, which is then the most prominent part, is nearly always found at the centre of the superior strait, when the lateral planes offer first, that skilful midwife designated them as *presentations of the shoulder*. M. Dubois, however, still retains the name of the *presentations of the lateral regions;* and these, like the others.

may either be regular or irregular. They are regular when the lateral line is directly at the centre of the abdominal strait, but irregular where the anterior or the posterior region of the trunk occupies this strait in a great measure, owing to the child being more or less inclined forward or backward; and it is to such irregularities that we must refer all those presentations of the back, loins, front of the chest and abdomen, described by the older authors.

On the whole then we admit five presentations, viz., one of the vertex, one of the face, one for the pelvic extremity, one for the right lateral plane, and one for the left lateral plane. Besides the presentations, Baudelocque, and all those who followed him, described a great number of *positions;* in each of which, according to their account, the mechanism of the labor was different. But M. Nægèle, in consequence of a better conducted study of this mechanism, has succeeded in changing entirely this branch of the science, and has further proposed a reform in the positions, at least as important as what he has already made in the classification of the presentations. Thus, he simply divides the pelvis into two lateral halves, the right and the left, and these form the only points of departure at the superior strait; on the fœtus, the points admitted by Baudelocque are retained. For instance, in a vertex presentation, the occiput may offer at any one point whatever of the left lateral half of the superior strait, thereby constituting the first position of the vertex; or it may correspond in a similar way with the right lateral half, thus producing the second position; further, as the mechanism is just the same, whether the occiput be at first at the front, in the middle, or behind, we shall only consider these circumstances as so many varieties of the same position; which shades or varieties, in the great majority of cases, do not change the mechanism of the natural labor in any wise, and therefore do not deserve to be received as important elements in a classification, but of which, however, more account should be taken than appears to have been done by M. Nægèle, for they may be usefully recalled in explanation of certain anomalies, as also for successful intervention in some cases of difficult labor.

What has just been stated concerning the vertex equally applies to the positions of the face and breech; since in the former the chin may be directed towards some point, either on the right or the left lateral half of the pelvis; and in the latter the sacrum may have a similar relation with some point of its right or left half; therefore we adopt a first, or the *right mento-iliac*, and a second, or the *left mento-iliac* position for the face; and likewise for the breech we have a first, or the *left sacro-lateral*, and a second, or the *right sacro-lateral* position. Lastly, the two presentations of the trunk have each two positions: for example, the right side of the fœtus presenting, the head may happen to be placed either above some point on the left lateral moiety, or over a similar part on the right one. Hence, there are two positions: first, the *left cephalo-iliac*, and second, the *right cephalo-iliac;* or, if the child's left side presents in the same way, the head may be either to the left or the right, thus giving rise to two new positions, the *left* and the *right cephalo-iliac* position.

[Perhaps it would be better to adopt M. Jacquemier's expression and say, that when a shoulder presents, the acromion is directed sometimes toward the left and sometimes toward the right side of the pelvis. Hence we have two positions, left acromio-iliac and right acromio-iliac. The same idea is, therefore, expressed, whether we say that the right shoulder presents in a left cephalo-iliac or in a left acromio-iliac position, but the assumption of the acromion as the point of reference makes the nomenclature clearer and more uniform.]

There is scarcely a necessity for adding that the *anterior*, *transverse*, and *posterior* varieties, admitted for vertex positions, are also retained for the two fundamental ones of the face, the breech, and the right and left sides.

SUMMARY.

1. Vertex presentation, .	Left occipito-iliac, . .	3 varieties.	anterior, transverse, posterior.
	Right occipito-iliac, . .	3 varieties,	anterior, transverse, posterior.
2. Presentation of the face,	Right mento-iliac, . .	3 varieties,	anterior, transverse, posterior.
	Left mento-iliac, . .	3 varieties,	anterior, transverse, posterior.
3. Presentation of the breech,	Left sacro-iliac, . .	3 varieties,	anterior, transverse, posterior.
	Right sacro-iliac, . .	3 varieties,	anterior, transverse, posterior.
4. Presentation of the right lateral plane, ...	Left cephalo or acromio-iliac, . .		anterior, transverse, posterior.
	Right cephalo or acromio-iliac, . .		
5. Presentation of the left lateral plane, ...	Left cephalo or acromio-iliac, . .		
	Right cephalo or acromio-iliac, . .		

We would observe, however, that in shoulder presentations the varieties of position are far less important than in the other presentations, and that it matters very little whether the acromion and the head be more or less in front or behind.

But all the presentations and positions just indicated have not the same frequency, nor are they all equally favorable to the spontaneous expulsion of the child. There are some even, such as the positions of the trunk, in which this is most generally impossible, but there is no one, however, in which it absolutely cannot take place; therefore, we shall have to examine the mechanism of natural labor in each of these presentations successively, reserving to ourselves the privilege of reverting in the fourth part of this work to those which usually offer an insurmountable difficulty; and as the vertex presentations are the most frequent and favorable of all, we shall commence with a description of them.

ARTICLE II.

OF THE VERTEX PRESENTATION.

This presentation is far more frequent than all the others put together: thus, in 20,517 births reported by Madame Boivin, 19,810 children were born by the vertex; and in 2020 cases reported by M. Dubois, there were 1913 of this variety. Again, when the vertex presents, the occiput is much oftener directed towards the left than the right side: for instance, in the 1913 cases just cited, M. Dubois noticed 1367 left occipito-iliac, and only 546 right occipito-iliac positions. Nor are the three varieties pointed out for each position equally frequent: thus, in the 1367 cases where the occiput was directed to the left side, it was inclined forward, that is, towards the left cotyloid cavity, 1355 times, and only 12 times backwards, in the direction of the left sacro-iliac symphysis, or nearly so. But in the 546 instances of right occipito-lateral positions an opposite result was observed; for the occiput was only found 55 times at the right acetabulum, but 491 times at the right sacro-iliac symphysis; so that, contrary to the generally received opinion, the posterior right occipito-iliac position is much more frequent than the anterior one. We have given these results as ascertained by M. Dubois himself, because they are entirely consonant with our own observations, and with those of M. Stoltz, of Strasbourg.

In one hundred cases of vertex presentations, it has been found on an average, says M. Nægèle, that in seventy the occiput is directed in front and to the left, and behind and to the right in thirty; he considers the other varieties as being very rare and altogether exceptional.

In these results, no question seems to be made of the varieties we have designated as the transverse ones, and it is highly probable that they have been approximately added to one of the four preceding groups, for these positions are not very unusual; indeed, I have often met with them myself at the Clinique.

"These positions," says Madame Lachapelle, "are more frequent than those where the occiput corresponds to the left sacro-iliac symphysis;" and, I will add, than those where it is at the right acetabulum; also, that the left transverse occipito-iliac position is more common than the opposite one.

§ 1. Causes.

As we have already spoken of the cause of the vertex presentations, when treating of the child's attitude in the uterine cavity, we shall not now go over the same ground, but will only remark, that most accoucheurs attribute the frequency of the dependent position of the head to its own specific weight; whilst M. Dubois, after having endeavored to refute the general opinion, has considered this position as the consequence of an instinctive determination of the fœtus itself. (See art. *Fœtus.*) However, it is not at all difficult to explain why the left anterior, and the right posterior occipito-iliac varieties are the most frequent of any, since it is evidently owing to the presence of the rectum on the left side. The habitual distention of this bowel by fecal matters obliges the forehead or occiput to turn towards the front whenever either of these parts is directed backwards and to the left.

It is far more difficult to say why the occiput is so much more frequently found in front than behind, although this very probably depends on the same causes as those which determine the vertex presentation.

Thus, the posterior half of the head weighs far more than the anterior, and the same is true of the trunk; further, when the woman is standing, sitting, or on her knees, or even lying on the side, the anterior wall of the abdomen is the most dependent portion, towards which the child's heaviest parts, that is to say, its posterior plane, must necessarily tend.

§ 2. DIAGNOSIS.

[The presentation of the vertex and its positions may be determined by three different kinds of examination, viz., palpation of the abdomen, auscultation, and the vaginal touch.

Palpation of the Abdomen. — If the hands be placed upon the abdomen and the walls of the uterus depressed, parts of the fœtus may be felt and with a little practice distinguished quite readily.

To obtain the best results from this method, the woman should lie upon her back with the walls of the abdomen as much relaxed as possible, and by gentle pressure be accustomed to the contact of the hands. At the outset it is not uncommon for the examination to be interrupted by a contraction of the womb, which, of course, should be allowed to subside. After some trials, however, the abdominal muscles and the walls of the uterus yield to the pressure, so that the hand which explores the hypogastric region is enabled to distinguish with some precision a voluminous, hard and rounded mass which recalls exactly the size and form of the head of a child. Above it may often also be recognized the entire dorsal region of the fœtus, so that it only becomes a question between a presentation of the vertex and one of the face.

A circumstance which may embarrass physicians, who have but little experience in this kind of research, arises from the fact, that near the end of pregnancy, and especially in primiparous cases, it often happens that the entire head has descended into the cavity of the pelvis and necessarily escapes detection by the hand which confines itself to a superficial examination of the hypogastric region. In this case, if the ends of the fingers be placed above the body of the pubis and pressed downward as though to push the walls of the abdomen into the lesser pelvis, the head of the child will soon be felt filling the entire cavity. I have in hundreds of instances succeeded in this way in diagnosing the vertex presentation, and that without causing either pain or accident.

The presentation being determined, if the accoucheur can feel to which side the back of the child is turned, the palpation has enabled him to diagnose both presentation and position.

In the occipito-posterior positions, the greatest width of the womb is still at the upper part, as stated in the account of the normal condition; but the fundus is not so evenly rounded unless the quantity of fluid be very great: most commonly, says M. Stoltz, an arched projection may be detected at the fundus, and beneath it a sensible depression. The anterior plane of the fœtus being directed forward, the inequalities formed by its extremities, which are discovered with difficulty in occipito-anterior positions, are detected more readily.

A certain degree of importance ought, therefore, to be accorded to this kind of exploration, though we should be careful not to over-estimate its value. In the most simple cases we are sometimes liable to be deceived, and a mistake becomes easy when the walls of the abdomen are thick or the quantity of waters great. Finally, it should be understood that in some women the uterus is so readily excited to contraction, that it becomes impossible to depress its walls sufficiently to arrive at any result. Still another consideration which lessens the value of palpation is, that,

though it may be easy before labor comes on, it becomes difficult or even impossible at that time; all which is readily explained by the severe pains which it provokes and the facility with which it excites the contraction of the uterus.

Auscultation.—The diagnosis of the presentations and positions of the vertex may also be determined by auscultation. As Prof. Depaul has treated this subject thoroughly in his *Traité d'Auscultation Obstétricale*, I will merely state here, that in the presentation of the cephalic extremity, the maximum intensity of the pulsations of the heart are heard above a horizontal line passing through the umbilicus. To this law there are very few exceptions in a normal condition of the pelvis, and whatever relates to deformities need not detain us here.

Auscultation is not less important in order to determine the position. As in the fœtus the lungs are flattened against the vertebral column, the sound of the heart is transmitted to the ear through the dorsal region whose curvature is applied against the walls of the uterus; therefore, as the greatest intensity of the sounds of the heart is perceived over the spinal column, and as both it and the posterior fontanelle are directed toward the same side, we learn where the occiput is situated. In the left anterior occipito-iliac position the heart beats in front and to the left, whilst in the right posterior occipito-iliac position it is heard behind and to the right. The same reasoning indicates certainly the point at which the head ought to be heard for each particular position. To avoid being deceived by the data which auscultation supplies, we ought always to determine and fix precisely, not the point where the heart is heard merely, but the point where the sound is loudest. Without this precaution auscultation would be as deceptive as useful in the endeavor to determine the position.]

Vaginal Touch.—Before labor, and even during the last few months of gestation, the vertex can often be recognized as presenting; while in every other presentation the part that offers first, from being irregular, voluminous, and badly adapted to the form of the inferior uterine segment, and of the superior strait, is always so high up, and separated from the uterine wall by so large a quantity of waters, as to be scarcely accessible to the finger.

The vertex, on the contrary, presenting a rounded spheroidal surface, reposes, almost without the intervention of any liquid, on the uterine walls, nay, even presses them before it, and engages in the excavation, descending in some cases as low down as the floor of the pelvis. Hence, whenever the vertex presents, it is easily detected through the inferior portion of the uterine wall, unless, indeed, it should be retained at the superior strait by a considerable inclination of the womb, or by a malformation of the pelvis.

In a word (and this reflection appears to me essentially practical), whenever the accoucheur does not easily reach the presenting part in the last few days of the gestation, and more particularly during the first periods of labor, he should examine the woman very carefully; for it is then exceedingly probable that the head is not at the superior strait; or, even where the cephalic extremity does present flexed, there is reason to fear a wrong direction, or perhaps a faulty organization of the head or pelvis; all which circumstances may subsequently require the intervention of our art. We would, however, remark, that in women who have borne children the head often continues very high up until the end of gestation, and does not get below the superior strait until labor sets in.[1]

[1] A variety of circumstances may occur towards the end of gestation, or at the beginning of the labor, dependent on causes wholly foreign to any faulty positions, whereby it might happen that no part could be detected by the touch: thus, 1. It is sometimes observed in women who have had several children, and in whom the fundus uteri is

Supposing the labor has begun, if the finger be introduced through the cervix uteri, it will immediately encounter a rounded, smooth, and resistant surface, which is the anterior side of the head; and then, by directing the index a little further upwards and backwards, in the direction of the sacro-vertebral angle, it will come into contact with a membranous interval, that is, with the sagittal suture.

A vertex presentation is now ascertained; and the next step is to make out the position. For that purpose we first assure ourselves of the direction of the suture, and if it prove to be oblique, running from before backwards, and from the left towards the right, the position must either be the left anterior, or the right posterior occipito-iliac one; but, on the contrary, if it be oblique in the other diameter, the position will either be the right anterior or the left posterior occipito-iliac, &c.

The direction being once determined, we have then only to find out where the occiput lies, to complete the diagnosis; therefore, the finger, by raising up the margin of the os uteri, follows the sagittal suture until it reaches a fontanelle, which is to be distinguished by the characters hitherto described. (See *Head of the Fœtus at Term.*)

§ 3. MECHANISM.

The mechanism by which the expulsion of the child is accomplished in positions of the vertex is very nearly the same in all cases where the occiput corresponds with one of the points of the left lateral half of the pelvis; but it differs in some respects from that observed in the positions designated as the right occipito-iliac ones.

We must, therefore, examine it in both of these positions; and as, among the admitted varieties, there are two, the anterior in the left occipito-iliac, and the posterior in the right occipito-iliac, which are almost constantly met with, we shall take them up successively as the types of our description.

1. *Mechanism of Natural Labor in the left Anterior Occipito-iliac Position.* (The first, or the left occipito-cotyloid position of authors.)—In this position, the occiput corresponds to the left ilio-pectineal eminence, the forehead to the right sacro-iliac symphysis, and the sagittal suture lies in the direction of the left oblique diameter of the pelvis. (In order to avoid unnecessary repetitions and delays, we premise, once for all, that we shall designate that oblique diameter which runs from the left towards the right side, and from before backwards, as the *left oblique*, and the one passing from the right towards the left, and from in front posteriorly, as the *right oblique diameter.*) The posterior fontanelle is found to the left and in front, the anterior one is behind and to the right. The dorsal plane of the fœtus looks

FIG. 75.

Representing the head in the left anterior occipito-iliac position.

strongly inclined forwards; 2. In cases of twins; 3. In breech presentations; 4. Where there is a large amount of water; 5. Where the uterus is not oval at its inferior part: 6. Where the head is hydrocephalous; and lastly, where the pelvis is narrow. (*Naegèle*, translated by *Pigné.*)

forwards and towards the left side; while its anterior plane is directed backwards and to the right; the right shoulder is in front and to the right side; the left one is behind and towards the mother's left.

Before the bag of waters is ruptured, the child's head is slightly flexed on the front of the chest, and the following are the relations of its diameter with those of the superior strait: the occipito-frontal corresponds to the left oblique of the strait, and the bi-parietal to the right oblique;[1] and, of course, the occipito-frontal circumference of the head is parallel with the periphery of the abdominal strait, and the axis of this strait corresponds with the trachelo-bregmatic diameter[2] of the head.

When the membranes are ruptured, a variable quantity of liquid escapes; then the uterus contracts and applies itself more directly to the fœtal trunk; nevertheless, as but little fluid passes away in vertex positions at this time, there usually remains a sufficient quantity of it to render the pressure of the uterine walls on the child far from being immediate.

After the rupture, the object of the contractions is to expel it from the womb; the fœtus becomes more curved anteriorly, and its superior and inferior extremities more closely folded up; and from that moment, properly speaking, the mechanical phenomena of labor begin.

[The various movements communicated to the fœtus during labor tend to facilitate its expulsion, as will appear from the description of them about to be given under the usual term of the *stages* of labor.

[1] We may remark, however, with M. Dubois, that this last relation is not absolutely exact. For instance, if the head of the fœtus at term be found at the superior strait, so that the occipito-frontal diameter is parallel with the left oblique, the shape of the head will prevent the bi-parietal one from corresponding with the right oblique diameter. In fact, in this position the posterior extremity of the bi-parietal diameter is at the left sacro-iliac symphysis, but the anterior extremity, instead of terminating opposite the ilio-pectineal eminence, is found very near the middle of the horizontal branch of the pubis.

[2] M. Nægèle and Professor Dubois (who adopts, at least in part, the views of the Heidelberg Professor) do not believe that the head presents at the superior strait, in the majority of cases, so regularly in all its relations as we have just described, for they say the head does not offer perpendicularly to the plane of the strait, but on the contrary, in an oblique direction; whence the right parietal protuberance, which is also the anterior one, would be lower, relatively to the plane, than the left; and the bi-parietal suture, instead of being found in the direction of the axis of the head, would be a little behind it, according to M. Dubois, and would even look towards the second bone of the sacrum, agreeably to M. Nægèle.

But, notwithstanding these imposing authorities, we believe the occipito-frontal circumference is closely parallel to the plane of the strait in most cases, although the parietal boss is certainly one of the most dependent parts of the head, and the finger first strikes upon it in practising the vaginal examination. But those facts by which M. Nægèle sustains his views prove just the contrary; because the plane of the abdominal strait, being directed very obliquely downwards and forwards, the portion of the head in contact with the anterior arch of the pelvis should be its most dependent part; and further, the finger first encounters the anterior parietal protuberance, because the introduction takes place under the symphysis pubis, that is to say, almost perpendicularly to the superior strait, and therefore the index can only reach, in a very oblique direction, the anterior portion of the head, whose greatest circumference is parallel to the plane of the superior strait.

Five principal stages have hitherto been reckoned in vertex presentations; they are, following the order in which they occur: 1st. flexion; 2d. descent; 3d. rotation; 4th. extension or disengagement; 5th. restitution. To these five stages we think it proper to add a sixth for the expulsion of the body. At the end of this chapter (see *Recapitulation of the Mechanism of Labor*), we shall state more fully the reasons which induce us to alter the number of stages as usually described, remarking only for the present, that we think it gives the advantage of a classification which is both more rational and applicable to every presentation. In the account of the mechanism of expulsion for each presentation we shall, therefore, describe six stages.

It will be seen that this innovation does not call for a change in the generally received opinions, inasmuch as we have only to reunite the fifth and sixth stages to restore the old classification.]

These phenomena, or stages of the mechanism, are five in number, as follows: in the first, the head is more strongly flexed on the chest; in the second it traverses all the space between the superior and inferior straits, and reaches the floor of the pelvis; there it experiences a movement of rotation which carries the occiput behind the symphysis pubis, thus constituting the third period; in the fourth, the head undergoes the process of extension, by which all the superior and anterior parts of the vertex and face become completely disengaged at the anterior commissure of the perineum; and then, after its perfect expulsion, the child's cephalic extremity performs a fifth and last movement, designated by Baudelocque as the period of restitution, but which M. Gerdy has proposed to name the *exterior rotation*.

A. *First Stage, or Stage of Flexion.*—After the rupture of the membranes, the fœtal trunk, being compressed on all sides, transmits to the head, through the spine, the impulse derived from the uterine contractions. The head, being forcibly pressed on, has a tendency to clear the uterine orifice, and to engage in the excavation. But it then encounters resistances, either from the os uteri, which is not yet sufficiently dilated, or from the superior strait, or the walls of the excavation; and being thus placed between a power and a resistance, the head must naturally become still more flexed on the chest; in fact, the force of expulsion transmitted by the vertebral column, falling upon the occipital foramen, that is, on a point much nearer to the occiput than the chin, must necessarily (the resistance being equal at the two extremities of the occipito-mental diameter) act more powerfully on the occiput than on the chin; in other words, must press down the occiput into the excavation. But, by depressing this part, the chin is forced to ascend, thus producing the flexion of the head.[1]

Fig. 76.

The head in the same position, though more flexed.

[1] In order to prove that the movement of flexion results from the position of the occipital foramen, relatively to the chin and occiput, which represents the two extremities of the lever whereon the spine is articulated, let us suppose, for a moment, that

The head being in this way forcibly flexed, its relations are changed. that is, the occipito-bregmatic diameter has taken the place of the occipito-frontal, and has become parallel to the left oblique of the strait; but the bi-parietal remains unaltered: the occipito-bregmatic circumference is now on a level with the periphery of the strait, and the axis of the pelvis, which before corresponded with the trachelo-bregmatic diameter, now traverses the head very nearly in the direction of the occipito-mental diameter.

This movement of flexion, therefore, evidently places the child's head in the most favorable position for its passage, by constraining it to offer its smallest diameters to those of the pelvis.

B. *Second Stage, or Stage of Descent.*—The head, pressed on by the contractions, enters the excavation and reaches the floor of the pelvis. In making this descent, the occiput presses in front against the internal and anterior face of the body of the ischium, the obturator internus muscle, and the external obturator vessels and nerves, which pass out through the upper part of the obturator foramen; while the forehead or bregma presses behind on the internal border of the psoas and pyramidal muscles, the sciatic plexus of nerves, together with the gluteal and the internal pudic vessels and nerves. The left side of the head likewise comes into mediate relation with the same parts, and also glides over the anterior surface of the rectum. But the descent of the head is not completed until the occipito-bregmatic circumference is nearly parallel to the plane of the inferior strait: that is, when the two parietal protuberances have attained this level. Now, it is evident that, to reach this point, the left parietal boss (which is found behind) must traverse the whole anterior face of the sacrum, whilst the anterior one has only to clear a much shorter space; the first must therefore describe the arc of a much larger circle than the second. Perhaps a more exact idea of the actual movement of the head will be formed by imagining the anterior extremity of the bi-parietal diameter to remain nearly stationary in front and to the right, while its posterior extremity descends rapidly and traverses the whole posterior plane of the excavation.

the vertebral column is attached to the occiput alone, when it is evident that the latter only will descend; on the other hand, let it be made to the chin, which will then descend the first, and lastly let it be done at the centre of the interval between these two extremes, and an equilibrium will be produced, the same as results from equal weights or resistances placed in the dishes of a balance having equal arms. But where the articulation takes place nearer one extremity than the other, the descent will occur at this extremity, just as it would happen in the above-cited balance, if, without altering anything else, the arms were rendered unequal in their length.

To conclude, lest the foregoing should not satisfactorily explain the phenomenon, I propose the following rationale: the head, urged on by the uterine contraction, communicated to it by the spine, meets with resistance from the os uteri, which is not yet sufficiently dilated. Let us change, for an instant, the order of forces, making the vertebral articulation a fulcrum, and the opposition on the part of the neck the power; now, this power is evidently equal in all points of the periphery of the neck; but let us observe that, as the interval between the chin and the occipital foramen is greater than that betwixt the latter and the occiput, the resistance against the chin operates on a longer lever than that against the occiput, and consequently the first must be the more powerful of the two, and therefore it forces the chin to ascend. But raising the latter has the same effect as depressing the occiput: that is, still producing a flexion of the head.

C. *Third Stage, or Stage of Rotation.*—The head, being arrested by the floor of the pelvis, executes a movement of rotation, during which the occiput passes from left to right behind the symphysis pubis, or rather behind the left ischio-pubic ramus, and the bregma rotates into the concavity of the sacrum, though remaining a little towards the right.

The posterior superior part of the right parietal bone then appears plainly under the pubic arch; the posterior fontanelle is behind the ischio-pubic ramus; and the sagittal suture crosses the coccy-pubal diameter very obliquely. Being forced on by the energetic contractions of the womb, the vertex then depresses the soft parts of the perineum, and by gradually distending them, succeeds in converting the pelvic floor into a part of a canal which prolongs the posterior wall of the pelvis downwards and backwards. It is during this time that the rotation is accomplished: that is, the sagittal suture becomes parallel with the antero-posterior diameter of the inferior strait. The occiput engages in the arch of the pubis, and projects beyond the lower part of the symphysis, until the back part of the neck comes into contact with it, when the anterior progression of the occiput is arrested.

D. *Fourth Stage, or Stage of Extension.*—Just at the moment when the occiput engages in this manner in the pubic arch, the shoulders and upper part of the body enter the excavation, and in engaging there, the fœtal trunk, which is flexible, accommodates itself to the direction of the canal, and consequently bends over a little on its posterior plane.

[The head then presses upon the perineum, distending it and transforming it into a groove or gutter which conducts the occiput to the vulvar opening, so that if the patient be uncovered the accomplishment of the fourth stage may be witnessed by the observer. At each contraction the head descends and the perineum is elongated; then, as the pain subsides the perineum contracts, at the same time pressing the head a little upward. Finally, during a fresh effort the vulva opens and the occiput shows itself beneath the arch of the pubis. At this moment the head is still flexed, but soon the nucha seems to fix itself behind the pubis, and the head, by executing a movement of extension, escapes completely from the vulvar orifice, bringing successively into view after the occiput, the vertex, forehead, nose, mouth, and chin; the latter, which is the last to emerge, remains applied against the posterior commissure of the vulva and directed toward the anal region.

This movement has received what seems to us a curious explanation, for, according to the commonly accepted view, the pressure transmitted by the spinal column to the head is divided at the occipital foramen into two forces, one of which is applied to the occiput, and the other to the chin. Therefore, when the occiput is engaged beneath the pubic arch, the portion of force which is transmitted to it is lost upon the point of contact between the vertebral column and the posterior part of the pubis, whilst the force directed upon the chin continuing to act depresses it, causing it to depart from the breast and thus producing the movement of extension

Now, this explanation seems to us fallacious; for is it not evident that whilst the occiput is beneath the pubic arch, all the soft parts which make up the perineum press the anterior part of the head against which they are applied upward and backward, so that the movement of flexion is, at this juncture, at its utmost limit?

Our own view of the disengagement of the head is as follows: The body descends into the cavity of the pelvis, whilst the head is depressing and distending the perineum, and the chin remains applied to the breast not merely until the moment when the occiput takes its place behind the pubic arch, but even until the bregma makes its appearance at the posterior commissure of the vulva. Then it is that the

perineum acts like an elastic splint which, on the one hand, presses the head upward beneath the pubic arch, whilst on the other it slips rapidly over the face which it leaves uncovered, and retracts toward the coccygeal region where it is attached

The disengagement of the occiput and vertex begins only when the head is pressed downward sufficiently by the body; but at this moment the perineum, which until then was but passively distended, resumes its action and retracts as just stated, imparting to the whole head, whilst slipping over the face, a movement of extension which has the arch of the pubis for its centre. Therefore, it is only in this second period of the process of disengagement of the vertex, that the movement of extension is truly evident.

If the perineum were entirely absent, the head would disengage at the outlet of the inferior strait, without exhibiting its movement of extension. In the normal condition, however, and especially in primiparæ, the perineum, converted into an elongated gutter, arrests the downward progress of the head and directs it forward as upon an inclined plane.

Do we not also know that in breech cases, especially in primiparæ, the pelvic extremity in emerging from the vulva is directed just as obliquely upward and forward as the lateral flexion of the body will allow? This flexion, which no one will deny to be produced by the soft parts of the perineum, is, in our opinion, sufficient to prove that the movement of extension in delivery by the vertex is effected only by the curvature and elasticity of the genital passages, for, if the movement of the head at this time is very extended, it should be attributed to the great mobility of the articulations which permits the occiput to rise up in front of the pubis. In breech cases the same phenomenon occurs, though the extent of motion is greatly restricted by the rigidity of the spinal column in the lumbar region.]

Whatever explanation be accepted, if we observe what takes place during this movement of extension, the following points are seen successively to appear at the anterior commissure of the perineum, viz., the bi-parietal suture, the bregma (or fontanelle), the coronal suture, the nose, mouth, and, last of all, the chin. During this process, the sub-occipito-bregmatic, the sub-occipito-frontal, and the sub-occipito-mental diameters successively pass the antero-posterior diameter of the inferior strait. As soon as the occipito-bregmatic circumference is beyond the vulva, the anterior border of the perineum, yielding to its natural elasticity, retracts strongly, slips over the face, and embraces the neck; and just at that moment the head, which was before forcibly turned up in front of the mons veneris, falls back from its own specific weight, towards the anus.

Fig. 77.

The head is seen in various degrees of extension, the nape of the neck resting first behind, and then under, the symphysis pubis.

E. *Fifth Stage, or Stage of Exterior Rotation.* (Restitution.)—The head remains for a few seconds in this position, and then it is seen to describe a fifth and last movement, namely, the occiput inclines towards the internal surface of the left thigh, and the face turns towards the right thigh. This process is usually denominated the *restitution*, for the following reason: Before the researches of M. Gerdy, it was generally supposed that when

the head executed its movement of rotation within the pelvis the trunk did not participate therein, and that the operation could only take place through the aid of a certain degree of torsion in the neck; and, further, that the head becoming completely disengaged, the neck untwisted, and the head was *restored* to its natural relations with the trunk.

M. Gerdy was the first to demonstrate the faultiness of this explanation; for, in fact, the trunk does participate in the head's rotation, in such a way that the shoulders, which, in the beginning of labor, corresponded to the oblique diameter, are nearly transverse after this movement (the right shoulder, nevertheless, remaining always a little more in front than the left). The shoulders then reach the inferior strait in a transverse position, presenting, therefore, their great, or bis-acromial diameter, to the smallest one of this strait; but here they encounter some resistance, under the influence of which the rotation is effected in the opposite direction to that of the head; the right shoulder, passing from the right side towards the left, approaches the apex of the pubic arch, while the left one gets into the perineal concavity, and the head, being free externally, necessarily follows the movement communicated to the shoulders.

The rotation of the head is not therefore an isolated movement peculiar to itself, as Baudelocque supposed, but one secondary to the rotation of the shoulders.

I must remark, however, that, in some cases, the head has appeared to me to execute a double movement; for, immediately after its expulsion, it turns very slightly; the occiput passing a little to the left, the forehead towards the right; after remaining some seconds in this position, it then undergoes the secondary movement just described, which is due to the rotation of the shoulders. The first of these movements has already seemed to me to result from the untwisting of the neck, and is the true movement of restitution of Baudelocque.

F. *Sixth Stage, or Stage of Expulsion of the Body.*—The shoulders present at the inferior strait soon after the head, and, as we have just stated, nearly always in a transverse position. The right one gets under the right ischio-pubic ramus, while the left one lies in front of the left sacro-sciatic ligament. The bis-acromial diameter is rarely found in the direction of the antero-posterior diameter of the inferior strait. The anterior or sub-pubic shoulder is the first to appear in the vulvar fissure; although, as a general rule, the posterior one, after having traversed the perineal curve, is first disengaged at the anterior commissure of the perineum, and the right one is subsequently delivered.[1]

[1] Contrary to the generally received opinion, M. P. Dubois supposes that the anterior shoulder is the first delivered. That is certainly true in a great number of cases, but we have most usually observed the opposite fact; besides, there is a theoretical view which militates in favor of our opinion, that is, the left shoulder, being placed in contact with the posterior plane of the excavation, is situated, much more than the anterior one, in the direction of the uterine axis, or the axis of the superior strait, and therefore being subjected to a more energetic uterine impulse, consequently must be delivered first; further, it was necessary this should be so, as the posterior shoulder has much the longer course to traverse. Again, if I might refer to my own observations, I would say that in women who have before borne children, more especially in

During the disengagement of the shoulders, the fœtus becomes flexed on its right lateral region so as to accommodate itself to the curvature in the pelvic canal; and very soon after the remainder of the trunk is expelled, sometimes describing a very prolonged spiral course in its passage.

2. *Mechanism of Natural Labor in the right Posterior Occipito-iliac Position.* (The fourth of Baudelocque, and the third of M. Capuron.)

In the vast majority of cases, the mechanism of labor in this position scarcely differs from that just described, and therefore we only need allude here to the principal peculiar phenomena of the travail, without repeating all the preceding details.

It, likewise, is composed of five periods, or stages; before the membranes are ruptured, the diameters of the head correspond with the same diameters of the pelvis, as in the foregoing case, and the only difference to be remarked is, that the occiput corresponds to the right sacro-iliac symphysis, and the forehead to the left ilio-pectineal eminence. The child's posterior plane looks backwards and towards the mother's right, while its anterior plane is in front and to her left; its left side is placed in front and on the right, its right side behind and to the mother's left.

A. *First Stage, or Stage of Flexion.*—The head is flexed by the same forces as in the preceding case, and this flexion determines similar changes in the relations of its diameters with those of the pelvis.

B. *Second Stage, or Stage of Descent.*—This stage presents nothing worthy of particular notice.

C. *Third Stage, or Stage of Rotation.*—The head having reached the floor of the pelvis, undergoes a movement of rotation, in consequence of which the occiput traverses the whole right lateral moiety from behind forwards, in such a way that it passes successively towards the right extremity of the transverse diameter, behind the cotyloid cavity and under the right ischio-pubic ramus, while the forehead, or bregma, revolving in an inverse direction, goes from before backwards towards the hollow of the sacrum; and thus, the position which was originally occipito-posterior, becomes converted into an occipito-pubic, or anterior one, and the labor then terminates just as it does in those cases where the occiput was primitively in front.

[D. *Fourth Stage, or Stage of Disengagement.*—This presents nothing peculiar.

E. *Fifth Stage, or Stage of Restitution.*—The movement in this case is entirely analogous to that already described in connection with the left anterior occipito-iliac position, and is due to the same causes. It is the left shoulder, however, which gets behind the arch of the pubis, and the occiput is directed toward the right thigh.

F. *Sixth Stage, or Stage of Expulsion of the Body.*—This takes place under the conditions already described.]

Irregularities in the Disengagement.—In some instances, which are rare, however, this conversion does not take place, and the occiput remains behind until the termination of the labor. The delivery is then concluded in the following manner: the head is strongly flexed on the chest, and re-

those who have suffered from rupture of the perineum in former labors, the posterior shoulder is the first delivered; and, on the contrary, in primiparæ, the sub-pubic one has the precedence, the other being retained by the resistance from the soft parts.

Plate V

Fig 3.

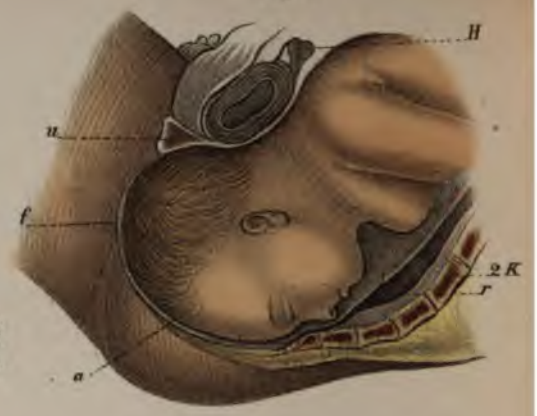


Fig. 2.

Fig 1

Fig 4.

PLATE V.

FIG. 1.

Section of the Frozen Body of a Woman in labor during the period of Expulsion.

a. Aorta. *d*. Duodenum. *F*. Bag of Waters. *M*. Stomach. *L*. Liver. *H*. Bladder. *Pa*. Pancreas. *u*. Urethra. *r*. Rectum. *v. p*. Vena portæ. *Pl*. Placenta. *o. e. o. e*. External Os Uteri, *o. i. o. i*. Internal Os Uteri.

FIG. 2.

Relations of the Muscular Floor of the Pelvis to the Last Stage of Labor.

1. Upper Margin of the Vaginal Ring. *2*. Ischio-perineal Ligament and Superficial transverse Muscle. *P*. Perineal body. *A*. Anus, flattened and carried back towards the Coccyx.

FIG. 3.

Engagement of the Head.

u. Urethra. *a*. Anus. *H*. Bladder. *2 k*. Second Sacral Vertebra *r*. Rectum.

FIG. 4.

Commencing Expulsion of the Head.

tains its oblique position; the forehead, corresponding to the body of the left pubis, first reaches the inferior strait, and the left coronal boss then engages under the pubic arch, where we can sometimes distinguish the superciliary ridge just below the symphysis; and I even saw the upper eyelid in one case. But though the forehead first appears at the exterior, the occiput, urged on by the spine, which transmits the force of the uterine contraction, traverses the whole curvature of the perineum (which is greatly distended in such instances), and becomes disengaged the first at the anterior commissure. While the occiput is thus passing over the anterior surface of the sacrum and perineum, the coronal boss and eyebrow, that originally appeared at the vulva, reascend and become concealed behind the symphysis.

Fig. 78.

Disengagement of the head in the occipito-posterior positions.

The occiput is scarcely clear, when the perineum by gliding over the inclined plane formed by the nape of the neck, retracts strongly, and thus facilitates the subsequent delivery of the anterior portions of the head; therefore, the head may be observed to undergo the process of extension around the nape as a centre, and to appear below the symphysis in the following order: namely, the anterior fontanelle, the coronal suture, the forehead, nose, mouth, and chin.

Lastly, the head, placed in the right posterior occipito-iliac position, may, when once down in the excavation, depart from the chest, and the vertex presentation be thus spontaneously converted into one of the face, at the inferior strait; we witnessed a case of this kind at the Clinique in 1838.

This transmutation takes place, says M. Guillemot, in the following manner: the occiput being arrested by some point on the posterior part of the excavation, instead of advancing along the perineum towards the inferior strait, ascends in the curvature of the sacrum by executing the movement of rotation backwards, and being at the same time thrown back upon the posterior part of the chest. While this is going on, the forehead and face descend behind the pubis and pass downwards and backwards, until the chin engages under the arch, and then the head, which is completely turned back, traverses the perineal strait, as in a face presentation.

The disposition which the inclined plane of the cervix uteri impresses on the vertex in this position, continues M. Guillemot, is a *frequent* cause of a similar transmutation above the abdominal strait. The slight backward inclination of the head, which always exists in these positions, may correct itself when the uterine contractions, by acting on the fœtus, keep the chin applied to the neck; but, on the other hand, the reversion may be carried still further, or be entirely completed, if any obstacle impedes the descent of the occiput into the excavation; finally, in cases of uterine obliquity, where the inclination of the vertex is greater, the backward tendency, instead of disappearing, would be increased, and the occiput would then ascend and the forehead descend.

Like the author quoted, I admit the fact, though I think it rare; but I cannot acknowledge, like him, the truth of the following proposition, *i. e.* that if the conditions of transmutation which then exist may be appreciated by a comparison of the face labors with those of the occipito-posterior positions, we should not depart far from the truth (*I believe it would be a wide departure*) by announcing that, in every three occipito-posterior positions, one of them would give rise to a face presentation.

Lastly, whatever may be the mode of the delivery of the head in the right posterior occipito-iliac position, the occiput always inclines towards the internal surface of the right thigh, and the face is directed to the left one; this external movement (*restitution*) results from the internal rotation of the shoulders, in consequence of which the left shoulder, which was originally the anterior, gets under the arch of the pubis, and the right one into the hollow of the sacrum, and then the shoulders and the remaining part of the trunk are expelled in the manner already stated.

Observations relative to the Mechanism of Delivery in Vertex Presentation.—The great care we have taken in describing the natural labor in these two varieties of the two fundamental positions, will absolve us from repeating it anew in the other varieties.

In fact, the left *transverse* occipito-iliac position does not differ from the *anterior* one; unless, perhaps, the movement of rotation, which brings the occiput in front, is somewhat more extended; and what we have stated concerning the two modes of termination in the *right posterior* occipito-iliac position applies equally well to the *left posterior* one; but we must add that the movements of rotation will then take place from left to right, since the occiput is primitively turned towards the left side.

Lastly, in the other two varieties, the *right anterior* and the *right transverse* occipito-iliac ones, the mechanism is still the same as in the corresponding varieties of the left occipito-lateral position, the occiput, however, turning from right to left so that the rotation occurs toward the right thigh.

From the foregoing, the reader will see that, in order to study the mechanism of labor in the vertex positions, we have been obliged to consider each of the periods, or stages, composing it separately. Thus, we first examined the movement of flexion, then of descent, next the internal rotation, the extension, and the external rotation; but it must not be supposed that these different movements occur successively, one after the other, in the order just described.

1. The forced flexion spoken of as happening before the descent, frequently only takes place simultaneously with the latter. Often, indeed, the head is not flexed until the descent is completed, and it encounters the resistance from the floor of the pelvis; and then only, in the majority of cases, is the flexion carried to its highest degree. We can imagine that this would nearly always be the case, since the head is engaged in the excavation in most women long before the commencement of labor; and even in those cases where it is still above the superior strait at the time of the membranes being ruptured, the presenting diameters will allow it to traverse the upper part of the excavation without meeting any marked resistance.

The movement of flexion likewise presents some irregularities: for instance,

it is not at all unusual, more especially in the occipito-posterior positions, for the chin, instead of approaching the chest, to depart from it; and, consequently, for the head to become more extended, and the anterior fontanelle gradually so get towards the centre of the excavation. However, this anomaly is usually temporary, for the head is flexed anew when it reaches the pelvic floor.

In some rare cases, the opposite of the preceding, the posterior fontanelle occupies the centre of the excavation, either because the flexion has gone beyond its usual limits, or else, because the trunk is inclined backwards; but here, also, the resistance from the perineum gradually brings back the head to its regular situation. (P. Dubois.)

2. The rotation sometimes commences prior to the arrival of the head at the inferior strait, and before the descent is completed. So that, in such cases, the three first stages of the labor occur at the same time; thus the head is flexed, descends, and rotates all at once.

Some curious varieties of rotation are occasionally met with, which should be known to the student. For instance, it may be incomplete, the head still retaining a great obliquity pending the whole duration of its disengagement; or it may not take place at all, which happens, as we have already seen, in certain occipito-posterior positions, or it may also occur in the transverse ones. In this latter variety, which is the rarest of all, the occiput and the forehead disengage alongside of the internal surface of the ischiatic tuberosities; the occiput escapes first, and then the forehead by a movement of extension analogous to the ordinary mechanism. Madame Lachapelle reports having observed three cases of this kind. In some exceptional instances, the rotation exceeds the ordinary limits: thus, for example, if the occiput is placed in relation with the right sacro-iliac symphysis at the beginning of the labor, it may successively correspond with the right extremity of the transverse diameter, the posterior face of the right acetabulum, the symphysis pubis, and the *left cotyloid cavity;* and then, after a moment of repose, it retrogrades and places itself once more behind the symphysis. M. P. Dubois originally pointed out this fact, and I have twice since had an opportunity of verifying its truth.

Again, the rotation, by which the occiput is brought in front, sometimes only takes place just as the head is overcoming the final resistances from the soft parts; on one occasion, I observed and pointed out this fact, in a primiparous woman, to all the students then present at the Clinique; the child's head was in the right posterior occipito-iliac position, and it had descended to the pelvic floor and had cleared the inferior strait without rotation taking place; the perineum was forcibly distended, the vulva widely dilated, the parietal protuberances were engaged, and the occiput had but a few lines to pass over in order to escape at the anterior perineal commissure; when, under the influence of a new pain, the head rotated briskly, the occiput gained the front, the forehead simultaneously rolling into the perineal concavity, and the labor terminated almost immediately.

The rotation within the excavation is certainly one of the most curious movements executed by the fœtal head during the whole process of a natural labor; indeed, from what we have hitherto stated, it must be evident that

whatever be the primitive relations of the occiput with the various points of the circumference of the superior strait, it finally succeeds in getting under the symphysis pubis.[1] Now, the physical cause of this movement is nowhere given in the writings that have been published on the subject prior to M. P. Dubois, who has paid particular attention to this point, and who, after refuting the influence of the inclined planes, advanced by the older accoucheurs, as the cause of the movement, adds, "This cause evidently resides in the combination of a great number of elements, viz., on one hand, the size, form, and mobility of the parts which are expelled, and, on the other, the capacity, the shape, and the resistance of the canal traversed by them; and such is the influence of this association, that the fœtal parts place themselves in the most favorable conditions for delivery; thus, if an active resistance is made to them at one point, they withdraw from that, and seek another where there is more space and liberty. The mobility of the traversing parts, and the extreme lubricity of those which are traversed, *render all this very simple and intelligible.* In fact, every accoucheur must have remarked that, in those instances where the sacro-pubic diameter is contracted, the fœtal head, if oblique before the labor, constantly places itself then in a transverse direction, that is, in the one offering the least possible dimension to the shortened diameter; and this fact is nothing else than a very simple effect of those same causes, of which the rotation, when extensive, is a very complicated consequence." (*Journal des Connaissances Médico-Chirurgicales.*)

M. P. Dubois further relates the following experiment in support of his explanation of the process of rotation: "The flaccid and voluminous uterus of a woman, who died soon after delivery, was freely opened near the os uteri, and her fœtus was placed in it near the soft, gaping orifice, in the right posterior occipito-iliac position of the vertex; then several midwife students, by pushing the child from above downwards, caused it to enter the excavation without difficulty; but it required a much greater effort to make the head traverse the perineum and clear the vulva; and it was not without some surprise that we noticed, in three different trials, that, as soon as the head passed the external genital parts, the occiput was in front and to the right, while the face turned backwards and to the left. Again, we repeated the experiment a fourth time; but now the head passed the vulva, with the occiput remaining posteriorly. We then took a still-born child, delivered the preceding day, which was much larger than the other, and placed it in the same conditions as the first, and on two successive trials the head cleared the vulva after having performed the rotation; on the third and succeeding essays it was disengaged without executing this movement: that is, the process of rotation continued until the perineum and vulva had

[1] M. Nægèle has only known the occiput to disengage posteriorly seventeen times out of twelve hundred and forty-four occipito-posterior positions; and even in those cases it was always possible to appreciate the exceptional circumstances that had favored this irregularity: such as, an amplitude of the pelvis, or numerous former labors, lacerations of the perineum, or the softness, flexibility, *reductibility*, and want of consistence of the head, or an extreme smallness of the child, the presence of twins, &c., &c.

lost the power of resistance that produced it, or which, at least, had determined its accomplishment." (*Loc. cit.*)

I do not know whether the explanations and experiments of M. P. Dubois will render the cause of rotation *very simple and intelligible* to every reader; but, as to myself, I am constrained to admit that they describe and confirm the fact, but that they do not explain it. True, there can be no doubt that the cause of rotation is to be sought for in the form and direction of the canal, and in the shape and size of the fœtal head; but let us see if it would not be possible to ascertain the influence of those divers circumstances more precisely.

The uterus is situated very nearly in the axis of the superior strait, and therefore the sum of its expulsive forces, or, to speak more clearly, the sum of the contractions, may be represented as operating according to the direction of its axis. Now, supposing the head to be in the right posterior occipito-iliac position, the occiput, urged on by the uterine contraction transmitted by the spine, will descend in the line of its axis: that is, from above downwards, and from before backwards; and it will continue on until it is arrested by the resistance from the inferior and lateral parts of the pelvis, or from the soft parts constituting the floor of the perineum. There it is arrested, provided the resistance be considerable, and thenceforth the occiput must necessarily change its direction. In fact, the resistance may be represented by a force operating in a direction perpendicular to the surface whereon the head strikes, and which is applied to the fœtal cranium at its point of contact with the posterior plane of the excavation. This point of contact, in the case before us, is evidently the right lateral and posterior part of the head, which strikes against some point in the hinder wall of the excavation; the child's head, or rather the occipital extremity of it, is from that time subjected to two different forces, one of which acts from above downwards, before backwards, and slightly from left to right (this is the uterine contraction); and the other from behind forwards, and a little from below upwards (this is the resistance, or force, represented by the perpendicular to the surface impinged upon by the head). By representing this force derived from the resistance, and that from the uterus communicated through the spine in the line of axis of the superior strait by a parallelogram, we obtain a diagonal or resultant from these two forces that points out the direction of the movement that is to take place. Now, by constructing such a parallelogram, we observe that the occiput must evidently pass forwards, downwards, and to the right; since the diagonal or resultant of the forces is directed from behind forwards, from above downwards, and from left to right.[1]

The extent of this downward progress, and the rapidity of its execution, are always proportionate to the energy and duration of the contraction, and to the resistance offered by the pelvic floor. This also explains why

[1] In an article published in 1846, two years after the appearance of my first two editions, Prof. Simpson advanced nearly the same theory, adding that no one had before given a satisfactory explanation of this movement of rotation. Though glad to find my theory confirmed by that of the learned Edinburgh Professor, I am sorry to have to remind him that my first edition was published in 1840.

the rotation, after being a long time delayed, is sometimes suddenly and completely effected during a violent pain; as also why, under other circumstances, and more particularly in those instances where the pains are feeble or short, this movement only takes place gradually, and requires for its entire completion a much longer period and more numerous contractions.[1]

Lastly, this theory enables us to explain those differences noticed in the rotation according to the part of the excavation where it commences; thus, it has been stated that usually the process only begins when the child's head reaches the pelvic floor; indeed, this could hardly be otherwise, since until that period the head, from being strongly flexed, and offering its smallest diameters to those of the strait, had encountered no resistance whatever from the osseous portion of the pelvic canal; but we can readily imagine that if the head be voluminous, the pelvis rather small, the superior strait too much inclined, or the uterus too oblique, the resistances might be felt much sooner, and the occiput hardly have entered the excavation, before it would strike against the posterior wall and be compelled to follow the new direction impressed upon it by the resultant (diagonal) of the forces.

This explanation accounts readily for the absence of rotation, and the disengagement of the head in the posterior position. What, according to M. Nægèle, are the kinds of cases in which this exception has been observed? We have already stated them: they are those in which the large size of the pelvis, the slight resistance of the soft parts, occasioned by previous labors or ruptures of the perineum, or else the small size of the fœtus, or the reductibility of its head, permit its passage through the canal without encountering resistance, and, consequently, without any alteration of the first direction of the uterine force by a new one.

3. The trunk participates, as we have elsewhere stated, in the rotation of the head; this, however, may not occur; at least two cases reported by M. P. Dubois would seem to prove as much.

4. The rotation of the shoulders after the head is delivered may also present two opposite conditions; that is, it may either take place in a partial manner or else not at all, the shoulders then disengaging transversely. This last circumstance is not very unusual, and, in my opinion, clearly tends to confirm the views of M. Gerdy on the process of rotation; for when it does not occur, the head undergoes no rotation. But the latter should always execute this movement, however great the immobility of the shoulders, if the process is a consequence, as Baudelocque supposed, of the untwisting of the neck.

[1] This movement takes place gradually, says M. Nægèle, in a slow spiral direction; for if the vaginal touch be resorted to during the pain, the small fontanelle, which was originally directed to the right and posteriorly, will then be found to place itself altogether to the right, towards the descending branch of the ischium; but, in proportion as the pain diminishes, it returns step by step to the place it occupied before. Again, if the finger be kept in contact with the head, the posterior fontanelle, which in the absence of a pain is wholly to the right, will be observed, during the latter, to turn forwards towards the obturator foramen, from whence it again departs as the pain goes off; and it keeps up these alternate movements for some time, until finally it becomes fixed opposite this foramen.

Sometimes, on the contrary, the same movement that rendered the shoulders transverse before the delivery of the head continues after the expulsion of this latter in such a way, that the shoulder which was originally anterior, instead of retrograding towards the pubic arch passes behind, while the other that was primitively posterior gains the apex of this arch, and the face then turns towards the internal surface of the right thigh in the right occipito-iliac, and to the left thigh in the left occipito-iliac positions.

§ 4. Inclined, or Irregular Vertex Presentations.

Under the name of inclined, or irregular presentations of the vertex, we have designated those (page 311) in which the sagittal suture, instead of being placed very nearly in the axis of the superior strait, looks either to the fore or hinder part of the pelvis, as well as those in which the forehead or the occiput is placed at the centre of the strait, in consequence of the incomplete or exaggerated flexion of the head. Baudelocque and his school have considered these as so many distinct presentations, which they have accordingly denominated the presentations of the side of the head, or ear, forehead, and occiput; but we shall follow the example of Lachapelle, Nægèle, Stoltz, and P. Dubois, by including them all in the general term of vertex presentations. In fact, they scarcely ever impede the course of the labor, and seldom modify its mechanism.

For example, let us take the first position (the left anterior occipito-iliac), and suppose it to be inclined on its anterior (right) parietal region; then the right parietal protuberance corresponds to the centre of the strait, and the sagittal suture looks towards the first bone of the sacrum. When the contractions take place, the head will descend just as in a natural position, excepting that, upon its entrance into the excavation, or during the first half of the descent, it will undergo a movement of correction, in consequence of which the posterior parietal protuberance will describe an arc of a circle around the anterior one as a centre, and both will soon appear on the same plane, and the labor terminate as usual. Of course, this process of correction would operate in the opposite direction if the inclination were on the posterior parietal region instead of the anterior; however, the rectification is then much more difficult, owing to the direction of the expulsive force, which has a continual tendency to augment the inclination.

In those cases where the flexion of the head is incomplete, as in the forehead presentations of Baudelocque, it will become perfected during the descent, and the same will occur when it is exaggerated (the presentation of the occiput of Baudelocque); the forehead becoming lower and lower.

§ 5. Prognosis.

The vertex presentations are the most favorable of all, and this statement will be more fully verified when we study the prognosis of the other presentations.

But the vertex positions are not all equally advantageous; and we may lay it down as a general proposition that those in which the occiput is turned towards some point of the anterior half of the pelvis, at the beginning of the labor, are more favorable than those in which it looks posteriorly.

In occipito-posterior positions, the head, in the early part of the labor, generally remains quite high and less flexed than when the occiput is in front, a fact shown by the difficulty then experienced in reaching the posterior fontanelle. The descent, also, is very slow, and barely complete until rotation has brought the occiput in front.

In the latter case, as hitherto demonstrated, the labor may terminate by two varieties of mechanism which are altogether different from each other: that is, the occiput either comes in front, so as to get behind the symphysis pubis, or else it remains posteriorly throughout the labor.

Whenever the posterior position converts itself into an occipito-pubic one, the very considerable extent of the rotation then demands a rather more energetic contraction on the part of the womb than where the occiput was originally nearer to the anterior arch of the pelvis, and the labor is, therefore, somewhat more painful, though in general it is not serious.

But the expulsion becomes particularly difficult when the head maintains its primitive position, and does not rotate, as we shall endeavor to prove; though first, let us establish as an axiom, the evidence of which no one can deny, that *whenever a straight and an inflexible trunk has to pass through a curved canal, it will do so the more readily as the canal is shorter and less curved, or the trunk itself is the more diminutive.*

Now, in the folded condition exhibited by the child's body in vertex presentations, the trunk, which represents the great longitudinal axis, may be divided into two portions; one of which, constituted by the spine and the inferior extremities, is flexible, and can accommodate itself to the pelvic curvature, and, therefore, its expulsion should offer no difficulty; while the other, corresponding to all the space between the vertex and the atloido-axoid articulation, forms a straight, inflexible stem. Now, it is evident that in the primitive occipito-anterior positions, or in the posterior ones, which afterwards become converted into anterior, that portion of the straight inflexible stem which the long axis of the fœtus represents, is reduced to its smallest possible dimensions, and it only has to traverse *the shortest and least curved part of the canal,* I mean the symphysis pubis; whence one extremity is clear at the inferior, while the other is scarcely engaged at the superior strait. But does the same thing occur in those occipito-posterior positions that remain posterior until the end of the labor?

We know the occiput, in this latter case, is the first to escape at the anterior perineal commissure, and it therefore has to traverse all the front surface of the sacrum and of the greatly distended perineum. But as the child's neck is not long enough to thus measure the whole posterior wall of the pelvic canal, the chest must engage in the excavation soon after the head, and the latter, as a necessary consequence, must be forcibly flexed on the breast. Owing to this forced flexion, the straight inflexible stem extends not only from the vertex to the atloido-axoid articulation, but even to the first dorsal vertebra, and it is, therefore, *much longer* than usual; yet more, it has to traverse the whole anterior face of the sacrum prolonged by the perineum, that is to say, *the longest and the most curved part of the pelvic walls.*

Whence it is evident that the expulsion of the fœtus in this case must be

much more tedious and painful than in the others; however, we cannot admit that the delivery is absolutely impossible. M. Capuron, who still professes this latter belief, supposes (the occiput remaining posteriorly) that the labor can only take place when the fœtal head is unusually small, or the pelvis very large; but this opinion is opposed at the present day by too great a number of facts, to require us to refute the theoretical proofs upon which he relies.

There is yet another reason for the occipito-posterior positions being more difficult than the anterior ones; a reason to which sufficient importance has not, in my estimation, been attached: I allude to the mode in which the uterine contractions are transmitted. Observe, in fact, when the occiput is in front, that these are communicated to it by the spine, nearly in a direct line, whilst they only reach it when this part is posterior at the close of labor, by describing a well-marked curve, owing to the extreme flexion of the head on the chest.

Hence, there would be, as every one knows, a great loss of force; and observe further, that such loss coincides precisely with an occipito-posterior position, which, for the reasons before stated, occasions, of itself, still greater difficulties in the delivery.

Now, to have demonstrated that the labor is longer and more difficult in those cases in which the occiput remains posteriorly, is, in effect, to prove that it was at the same time more dangerous both to the mother and child.

In fact, it is in such instances especially that a rupture of the perineum is to be feared; it being very difficult indeed to prevent such an accident; it is then, also, those central lacerations of the perineum are apt to take place, in which the posterior commissure of the vulva and the sphincter ani remain intact, while the fœtus forces a way for itself through the distended perineum.

Such, indeed, is the effect of the length of the straight stem represented by the fœtus, and of the length of the curve represented by the canal, that in order to accomplish expulsion it becomes necessary either: 1. That the straight stem should break, or bend, so as to accommodate itself to the curvature of the canal, which is impossible; 2. That the curved canal should be straightened out; 3. That the walls of the canal should be ruptured; 4, or finally, that the delivery should become impossible.

Happily, in the majority of cases, the soft parts which form the continuation of the posterior wall, allow themselves to be straightened out; but when they resist, nothing but their rupture can allow of a spontaneous delivery, their considerable thickness affording the only explanation of the rarity of this accident.[1]

The head, by remaining a long time in the excavation, compresses the neighboring parts, thereby giving rise to retention of the urine, to eschars, and to urinary or stercoral fistulæ.

And apart from all these inconveniences, it is well known that the labor cannot be prolonged without danger; that the woman becomes fatigued and exhausted, and that the child remains compressed and painfully flexed.

[1] For an idea of the resistance sometimes presented by the perineum, see the article in the fifth part of the book, on The Application of the Forceps in Occipito-posterior Positions.

It has always seemed to me that in occipito-posterior positions, the left one is attended with much greater trouble than the right, the engagement of the head being generally more difficult, and its rotation much slower. Quite often, indeed, the occiput remains behind, preventing, in first labors, a spontaneous delivery, besides rendering much more difficult the application of the forceps, which then becomes necessary.

Whenever a fœtal head is examined, just after its delivery in a vertex position, there is always to be found a more or less considerable tumefaction on some point of the vertex, provided the labor has lasted long after the membranes were ruptured; and the size of this tumor bears a direct proportion to the more or less rapid progress of the labor. Its seat is so constant that it is easy to determine in what position the child was born by a simple inspection. (See Plate VI.)

For instance, when the occiput escapes under the pubic arch, the tumor is always located on the superior posterior angle of one of the parietal bones, *i. e.* on the right parietal in the left occipito-iliac, and on the left one on the right occipito-iliac positions; and in those rare cases, where the occiput is disengaged posteriorly, it is usually situated about the centre of the vertex, often indeed on the anterior fontanelle; in a word, it is mostly developed at the point which corresponded originally with the os uteri, and subsequently with the void under the pubic arch. The mechanism of its production is very easily understood, for the whole circumference of the head is strongly compressed, leaving only a single point corresponding to the void in the pelvis or arch, which is not subjected to that pressure, and which must, therefore, become the seat of a sero-sanguinolent infiltration, just in the same way as the skin does, when, by the application of a cupping-glass and the creation of a vacuum, it is thereby protected from the atmospheric pressure that operates on every other part of the body.

This tumor, when large, is the result of a slow and painful labor; it is always single; and may be distinguished from the cephalæmatoma, with which it was for a long time confounded, by the following characters: the former (or the tumefaction caused by labor) is irregularly circumscribed, whilst the limits of the latter are very distinct; in the former, the hairy scalp is of a well-marked violet color, the tumefaction has an œdematous consistence, retaining the impression of the finger, and is not fluctuating, whilst the skin of the cephalæmatoma is colorless, presenting a well-marked fluctuation, occasionally even some pulsations, and its base is limited by a prominent osseous border;[1] in some instances, however, this border is not developed for several days after the commencement of the disease; but the pulsations and the border are never met with in the other variety.

Lastly, the semi-sanguineous œdema of the cranium in new-born children appears immediately after birth, and disappears in from twelve to forty-eight hours; but the cephalæmatoma, on the contrary, though it may exist at the moment of birth, scarcely ever appears until some hours after the delivery, and then lasts for several weeks.

[1] This border is not always present at the beginning of the disease, sometimes not making its appearance until after several days.

Dr. Fortin relates that he was able, in one instance, to detect the presence of a cephalæmatoma as large as a pigeon's egg, before the labor was terminated: and a similar statement has been made by several authors.

The sanguineous tumor just spoken of does not exist when the fœtus dies prior to or during the labor, and before the membranes are ruptured; the inferences which the medical jurist can draw from this fact in cases where it is desirable to fix the period of death of a new-born child, are clearly obvious.

ARTICLE III.

ON THE PRESENTATION OF THE FACE.

It may happen when the cephalic extremity presents at the superior strait, that the head is not only extended, but also turned back towards the posterior plane of the child, which situation constitutes a face presentation. This presentation is very rare; thus, it has been ascertained, from the most numerous statistics, that the fœtus presents by the face, on an average, once in two hundred and fifty to three hundred labors.

We have admitted two fundamental positions for this presentation; in one of which, the chin looked towards some point on the right lateral half of the pelvis, the *right mento-iliac;* and in the other, it was directed to one of the points on the left lateral half, the *left mento-iliac* position; and we may repeat for the face what was said concerning the vertex presentations, namely, that there is no portion of the circumference of the superior strait with which the chin may not be in relation at the commencement of the labor; nevertheless, we shall include all these shades of position in the three principal varieties for each side; that is, for each fundamental one, we have the *anterior*, the *transverse*, and the *posterior* varieties.

The right mento-iliac positions are somewhat more frequent than the left; about in the proportion of thirty-one to forty-one, if we may judge from the statements of Madame Lachapelle. The *transverse* variety is rather more frequent than the right posterior one, which has been considered erroneously as the most common.

The face presentations are either classed as primitive or secondary, according to whether they existed before the commencement of labor, or were the result of ill-directed contractions. In fact, the latter have generally been considered as the more frequent of the two; but we shall have occasion to show the value of this supposition hereafter.

§ 1. Causes.

The obliquity of the womb, according to most authors, is the cause of face presentations, though all of them do not interpret its influence in the same manner. According to Deventer, if the womb be inclined to the right side, and the vertex be placed in the left occipito-iliac position, the contractions, taking place in the direction of the uterine axis after the membranes are ruptured, will force the fœtus from above downwards, and from right to left, so that the vertex will strike against the left border of the superior strait, and the head, being thus arrested, will be thrown back upon the posterior plane of the child. Baudelocque, though admitting the right

uterine obliquity, supposes that a right occipito ilial position of the vertex exists at the same time; for, says he, a face presentation is scarcely ever observed, without the obliquity of the womb being on the side which corresponds to the occiput. In this instance, the fœtus is lying on the right lateral wall of the womb before the labor sets in, and the head, obedient to its own specific weight, departs slightly from the chest; but when the contractions manifest themselves after the rupture of the membranes and the discharge of the waters, the direction of the forces transmitted to the head is such that, instead of falling on the occiput, as they would were the head flexed, they are spent on the forehead, and tend to force it down; but a depression of the latter compels the occiput to ascend: that is, causes an extension of the head.

The reader will perceive that all these explanations suppose that the face presentations are uniformly the consequence of deviations from a vertex position; but this, however, is not always the case, for the face may often present directly at the superior strait, even before the commencement of the labor or the rupture of the amniotic sac. For instance, Madame Lachapelle, when making an autopsical examination of two women who died at full term, found the fœtus presenting by the face; moreover, of the eighty-five face presentations collected by the authors of the *Dictionnaire de Médecine*, forty-nine had been clearly made out, and announced as such before the membranes were ruptured; and further, of those eighty-five women, there were but three in whom the uterus was in a state of well-marked obliquity, and only one where the quantity of the amniotic liquid was so great as to attract attention. Among the many predisposing causes considered as sufficient to account for face presentations, are coiling of the cord around the head of the fœtus, congenital enlargement of the thyroid gland, a large thorax—unusual length of the occiput, resistance to the occiput by the uterine or pelvic walls.

The reason for the greater frequency of the right mento-iliac position must evidently be owing, when secondary, to the greater frequency of the right lateral obliquity that produces it. There are several causes, according to Madame Lachapelle, which contribute to render the transverse positions more common than the others: as 1, the form of the superior strait and the length of its diameters, which correspond better in this direction with those of the face; 2, the frequency of oblique or transverse positions, which, when the head falls back, evidently give rise to transverse positions of the face; 3, the frequency of *lateral* obliquities of the uterus, or partial ones of the child, if, as Gardien admits, the fœtus can be oblique independently of the womb.

§ 2. Diagnosis.

[Palpation of the abdomen affords very little assistance in the diagnosis of face presentations. It will inform us, indeed, that the greater axis of the fœtus is in a longitudinal direction, and we may, perhaps, feel the head to be in relation with the pelvic opening; but how can we know whether it be flexed or extended?

The results of auscultation in face presentations are also less precise than in those of the vertex, so much so indeed that M. Depaul says it were too much to ask that it should enable us to distinguish between them. It is, however, well enough

to bear in mind M. Devillier's observation, that as the face engages less easily than the vertex, the maximum intensity of the cardiac pulsations may be heard at one of those points of the abdomen where they are commonly discovered in vertex presentations with obstruction at the superior strait. It may, therefore, lead to a mistake of which it is well to be forewarned.

Having determined that the face presents, if we resort to auscultation in order to diagnose the position, the following facts should be borne in mind: When the head is so forcibly thrown back that the occiput touches the upper part of the back, the entire trunk of the fœtus inclines towards its anterior plane, whilst the vertebral column has a strong backward direction. The sternum of the child, therefore, approaches the uterine wall whilst the back recedes from it, so that the maximum of the pulsations of the heart is no longer transmitted to the stethoscope through the vertebral but through the sternal region; in a right mento-iliac position, therefore, the maximum sounds of the heart will be heard toward the right side.]

By the touch only, can the diagnosis be made with certainty. Before the membranes are ruptured, the head in general is high, and difficult of access, so that it is almost impossible to reach the presenting portion, provided the membranes are the least tense. Again, the reversion of the head not being yet completed, the forehead is the lowest part, and the one the finger encounters in performing the touch; whence, by feeling a hard, rounded body furrowed by a membranous interval (the coronal suture), we might very readily mistake it for a vertex presentation. But if the flaccid and folded membranes can be depressed without difficulty, or, still better, if they have been recently ruptured, the diagnosis becomes easier. Then we find towards one side of the pelvis a rounded, solid surface, the forehead, traversed by a suture leading to a transverse depression; next a triangular elevation whose base, looking in an opposite direction from the forehead, exhibits two openings, the nares, and beyond this, a transverse fissure bounded by the superior and inferior maxillary arches. Sometimes, the finger, when introduced into the mouth of the child, has been clearly sensible of an effort at suction. On the sides of the median protuberance, two little soft tumors (the eyes) are felt, surrounded by an osseous circle; and lastly, when the head is low down, an ear may be detected behind the pubis. When the presentation is once determined, the position is easily made out, for the opening of the nostrils must evidently look towards that part of the pelvis which corresponds with the chin. When a long time has elapsed after the rupture of the membranes, new causes of difficulty are met with. Thus, the face, which now corresponds to the open space in the pelvis, becomes the seat of a considerable tumefaction, due to the same cause which produces the tumor of the scalp in vertex presentations. The cheeks, being greatly swollen, and at the same time compressed on the sides, project, and lie close to each other in front, thus leaving a deep fissure between them, in the bottom of which the distinctive characters of the face are entirely concealed; this fissure might very readily be mistaken for the one between the nates, which are then confounded with the tumefied cheeks. Further, the lips are also swollen, wrinkled, and everted, in such a manner as to offer a rounded orifice instead of the usual transverse fissure, and this orifice has been mistaken, in some instances, for the anus.

§ 3. MECHANISM.

We shall follow the example of Nægèle, Dubois, and Lachapelle, by taking one of those varieties, in which the chin looks towards one extremity of the transverse diameter, as the type in our description of the mechanism of natural labor by the face, and shall commence with the right mento-iliac

1. *Mechanism of Natural Labor in the right Transverse Mento-iliac Position.*—Before the membranes are ruptured, the head, as a general rule, is but moderately extended, whence the forehead is nearly always placed at the centre of the superior strait; the chin corresponding to the right, and the bregma to the left extremity of the transverse diameter. The diameters of the head hold the following relations to those of the pelvis: the mento-bregmatic corresponds to the transverse diameter of the pelvis; the bi-temporal to the antero-posterior one, and the mento-bregmatic circumference is parallel to the periphery of the superior strait; and, therefore, the pelvic axis traverses the head in the direction of the occipito-frontal diameter.

The posterior plane of the fœtus looks directly to the mother's left, and its anterior plane to her right; its right side is in front.

Early in the labor, the bag of waters projects into the upper part of the excavation, to an extent proportionate to the dilatation of the orifice; and its rupture generally takes place suddenly during a contraction, with considerable noise. The rupture is followed by the escape of a large amount of amniotic fluid, and the fœtus descends, and renders the diagnosis more easy.

As soon as the membranes are ruptured, the mechanism of the expulsion begins, and here, as in the case of the vertex, it is composed of six stages: *i. e.*, the forced extension, the descent, the rotation, the flexion or disengagement, the external rotation, and the expulsion of the body.

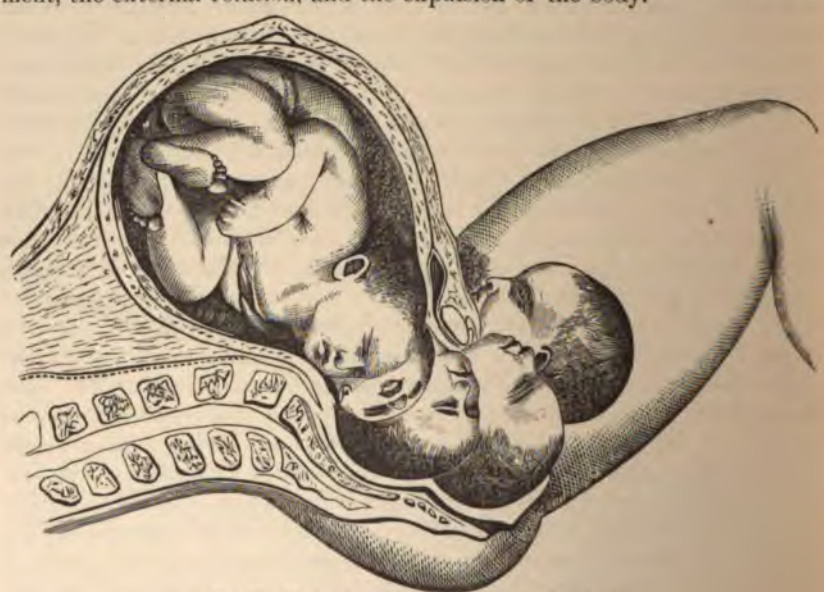


FIG. 80. Mechanism of face presentations (Schultze).

A. *First Stage. Forced Extension.*—The head being already moderately extended on the back, its extension will be completed during the first uterine contractions that take place after the discharge of the waters, owing to the resistance it will then meet with. This forced extension of the head changes but very little the relations of its diameters to those of the pelvis (Fig. 80); for instance, the fronto-mental has taken the place of the mento-bregmatic, and is now parallel to the transverse diameter of the strait; the bi-temporal has not changed at all; the facial, or fronto-mental circumference corresponds with the periphery of the superior strait,[1] and the pelvic axis traverses the head in the direction of a line passing from the posterior fontanelle to the child's upper lip.

B. *Second Stage. Descent.*—As soon as the head is freely extended, it engages in the excavation, and descends *as far as the length of the neck will permit.* This last sentence requires a short explanation. In the vertex positions, we have already seen that the head descended to the floor of the pelvis in such a way as to traverse all the space between the superior and inferior straits, without changing its position. But in the transverse position before us, it is clearly evident that the face can only reach the pelvic floor under one of the following conditions: that is, either the chest will engage along with the head in the excavation, or else it will remain above the superior strait; the face descending alone as far as the inferior one; that is to say, the forehead reaching the level of the left, and the chin that of the right tuber ischii; but then the neck must necessarily elongate enough to measure the whole length of the pelvis at its lateral portion, which is three inches and three-quarters. But as neither of these two conditions can be realized, the head will not be able to reach the pelvic floor; and it is for this reason that we say the face only descends *as far as the length of the neck will permit;* whereby the descent is interrupted.

C. *Third Stage. Rotation.*—The head then undergoes a movement of rotation, during which the chin rolls from right to left, so as to get behind the symphysis pubis, while the forehead rotates from left to right, and from before backwards, in order to place itself in the concavity of the sacrum. When this movement is effected, the descent becomes completed; for the shortness of the neck, or the too great extent of the ischium, formed heretofore the sole obstacle; if, therefore, by the process of rotation, the neck, which can be no further stretched, is brought into apposition with a part of the pelvic wall short enough for it to span its whole length, the descent may evidently be completed: that is, the breast still remaining above the superior strait, the chin may descend as low as the inferior one, and this is precisely what does take place; for, as the trunk participates in the rotation of the head, the neck gets behind the symphysis pubis at the same time that the chin reaches the lower edge of this symphysis, which is short enough to allow the neck to subtend its whole length.

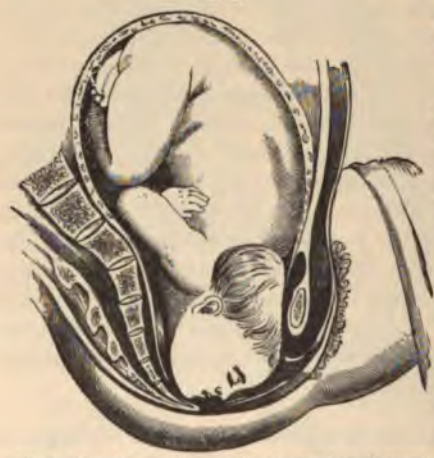
[1] M. Nægèle further supposes that the face is inclined relatively to the superior strait, and that the anterior cheek is the most dependent part, &c. The reasons upon which our objections were founded to such an inclination in the vertex presentations, oblige us also to reject it in the positions of the face, for we believe that the facial circumference is most usually *parallel to the plane*, as stated in the text

D. *Fourth Stage. Flexion.*—The process of flexion begins as soon as the descent is achieved; indeed, we may remark that, when the chin passes behind the symphysis pubis, the forehead goes into the hollow of the sacrum, and it therefore has to traverse, in order to arrive at the inferior strait simultaneously with the chin, the whole anterior face of the sacrum, that is, about five and a quarter inches, whilst the chin only descends the length of the symphysis, or one and a half inches; in a word, this is found just in the same condition as the posterior extremity of the bi-parietal diameter in vertex presentations; and, like it, the forehead has to describe an arc of a circle around the chin as a centre. Now, this arc cannot be described without a certain degree of flexion of the head. Whence it appears that, in this transverse position of the face, *the descent is completed at the same time that the rotation is taking place, and the process of flexion beginning.*

If the relations of the diameters of the head to the inferior strait be then examined, we shall find that the same ones are concerned as at the beginning of the labor, before the complete extension had occurred; thus, the mento-bregmatic corresponds to the antero-posterior diameter, the bi-temporal to the transverse, and the axis of this strait passes through the occipito-frontal diameter: and thus it should be; since, by the commencement of flexion, the head is replaced in the state of semi-extension it had when the labor began.

The chin, under the influence of the uterine contractions, next engages beneath, and continues passing under the inferior part of the symphysis, until the fore part of the neck comes into apposition with the posterior surface of the pubis; then the upper part of the thorax engages in the cavity, and the upper portion of the back presses strongly against the occiput: the occiput is depressed, and the head thereby compelled to complete its flexion or disengagement. Of course, the perineum becomes greatly distended, and the forehead, the bregma, the vertex, and the occiput, successively appear before its anterior commissure.

FIG. 81.



Illustrating the position of the head when forward rotation of the chin does not take place.

During the process of flexion, the præ-trachelo-frontal, the præ-trachelo-bregmatic, and the præ-trachelo-occipital diameters, clear in turn the antero-posterior one of the inferior strait.

E. *Fifth Stage. Restitution.*—This differs in no wise from the external rotation described by the head in the vertex presentations; for here, also, it is a consequence of the movement executed by the shoulders, in order to place themselves in the direction of the antero-posterior diameter of the strait.

[F. *Sixth Stage. Expulsion of the Body.*—This occurs as in cases of vertex presentation.]

In addition to the above, the mechanism of face labors sometimes presents a variety, which we purposely omitted for fear of interrupting the

regular description; thus, we stated, that the head completed its extension and descended, but that this movement of descent was interrupted by the rotation; after which the descent was completed, and at the same time the *flexion begun*. Now all the difference rests on this last point; for in practice a considerable number of cases, more particularly of the mento-posterior positions, are met with, in which the following phenomena are observed: the second movement, or the descent, actually commences, but is checked by the shortness of the child's neck. Then a certain degree of flexion takes place *before* the rotation occurs, in consequence of which the forehead descends to the pelvic floor, and the mento-bregmatic diameter places itself anew parallel to the transverse diameter of the excavation; then the process of rotation occurs, which carries the chin behind the symphysis, and the labor terminates in the manner just indicated.

2. *Mechanism of Natural Labor in the left Transverse Mento-iliac Position.*— In this position, the expulsion of the fœtus takes place in absolutely the same manner as in the preceding case. Only the chin, as well as the anterior plane of the child, is to the left; and hence the movement of rotation occurs from left to right instead of right to left, but all the rest is precisely similar.

The same is also true of the two varieties denominated the right and the left anterior mento-iliac positions. The two other varieties (the right posterior, and the left posterior mento-sacro-iliac) exhibit an identity of mechanism in a vast majority of cases: that is to say, the head, having reached a certain depth in the excavation, then undergoes the process of rotation, which converts the position into a mento-pubic one; indeed, the necessity for this movement is far more evident here than in the mento-transverse positions, since the depth of the pelvis is much greater behind than on the sides.

It may, therefore, be laid down as a general, nay, as an almost absolute rule, that, in the face positions, whatever may have been the relations of the chin with the circumference of the superior strait at the commencement of the labor, there must be a process of rotation, whereby the chin is brought under the symphysis pubis, before the labor can terminate spontaneously. The necessity for this rotary movement may be readily understood. In order that delivery may be accomplished with the face presenting, it is absolutely necessary that the chin should reach the inferior strait; now, in the extended condition of the head, the chin cannot reach this strait, except the neck be capable of measuring the depth of that portion of the wall of the pelvis to which it corresponds. If, therefore, the symphysis pubis be the only part of the pelvis which is short enough to allow the neck to measure its depth, it becomes indispensable that the chin should be turned forward.

In the numerous varieties of this position before admitted, the mechanism of the labor only differs in the greater or the less extent of the process of rotation; an extent evidently varying according to the point with which the chin was primitively in relation to the upper strait.

Remarks.—Nevertheless, the mechanism of the face positions occasionally offers some anomalies, that require a more special notice.

1. The rotation just described, whose object is to bring the chin constantly

towards the symphysis pubis, and which has been spoken of as absolutely essential to the spontaneous termination of the labor, may not be executed. But such very rare exceptions do not in the least discredit the general principle before laid down, for they may all be referred to those instances where the dimensions of the head are small relatively to those of the pelvis; or else to those cases in which the position of the face has been spontaneously converted into one of the vertex. True, Madame Lachapelle has known the face to escape from the vulva in a transverse direction, or nearly so, in two or three instances; but she carefully adds that they were very rare exceptions.

Now, to understand this movement of rotation, it is only necessary to recall our remarks concerning the mechanism of labor; thus, it has been shown that the descent could not be completed in the transverse positions, until the chin has turned towards the pubic symphysis; and further, that when the head is extended, the resultant of the forces transmitted by the spine falls very nearly on the chin, and tends to engage it still more. Well, in this situation, the expulsive force is either perpendicular or oblique to the plane of the resistance; if the former, the uterine efforts are lost, since they do not contribute in any wise to the progress of the labor; but, if the force is oblique to the resistance, it is so either from before backwards, or from behind forwards. In the former case, it will have a tendency to carry the chin backwards; but a movement of this kind will not aid in the engagement of the chin, since the pelvic wall is much higher nearer the median line; and hence the efforts are still lost.

In the latter, on the contrary, the oblique force, by operating from behind forwards, tends to carry the chin in front: that is, towards a portion of the pelvic wall, which becomes shorter and shorter as it advances anteriorly, and thus facilitates the descent.

But, after all, what is the direction of the uterine force? Everybody knows that it changes at each instant; according to the woman's position, or the power of the contractions, the womb may be successively found in all three of the directions above indicated, relatively to the resistant plane. If it is perpendicular to that plane, the efforts are lost; or, if oblique, from before backwards, the contractions are useless; they can only be fully efficacious when acting on the chin from above downwards, and from behind forwards. But far be it from me to attribute an intelligent force to the uterus; for it is only by groping along, so to speak, that the womb finally acquires a proper direction, though, when the impulsion is once given, the force becomes more and more oblique, and consequently more active. And it is those *gropings* (excuse the term) which at times render the rotation so difficult and so tedious.

It has been asserted, of late, that the process of rotation is quite as easy in the mento-posterior as in the mento-anterior positions. Now, if I have succeeded in making my views of the cause and mechanism of this movement understood, the reader will readily comprehend that, in proportion as the chin is turned backward, and more especially if towards the right at the same time, the greater will be the difficulty of its accomplishment, since the resultant of the uterine forces becomes nearly perpendicular to the plane of resistance.

2. As regards those varieties in which the chin looks backwards, we have already stated that it is necessary this part should come round in front, though some cases of mento-posterior positions, that terminated spontaneously, are found in the books, where the chin did not get under the pubic arch; writers differ in their explanations of this anomaly. M. Velpeau takes as an illustration the mento-sacral variety, or the second position of Baudelocque, in which the chin is turned toward the anterior face of the sacrum (though we may observe, in passing, that this position is scarcely admissible); and he remarks that, as the chin does not rotate in front, the following phenomena may then take place: the forehead engages behind the body or the symphysis of the pubis, while at the same time the chin gets below the sacro-vertebral angle. The whole head descends into the excavation beyond the anterior fontanelle for the anterior plane, and the face drags after it the front surface of the neck, and even the upper part of the chest behind. The occipito-mental diameter, which still represents the axis of the strait very nearly, now begins to perform a see-saw movement from above downwards, and from behind forwards. The chin, penetrating further and further towards the bottom of the excavation, though at the same time retained by the thorax, which cannot advance, forces the sagittal suture to slip down behind the pubis, and the forehead to gain the upper part of the inferior strait. The frontal protuberances soon find a point of resistance on the perineum, and the posterior fontanelle descends in turn, and ultimately appears at the summit of the arch, when the head finally escapes from the vulva as it would in an occipito-anterior position: whence it follows, adds M. Velpeau, that the *occipito-frontal is the greatest diameter* which can present at the planes of the straits. But we cannot admit the truth of this last proposition; for if, as he says, the chin is in relation with the anterior surface of the sacrum, and it *descends* more and more, while the occiput slips behind the pubis, it is evident that the *occipito-mental* diameter must, at a given moment, traverse the antero-posterior one of the excavation. Now, as this is clearly impossible, we have to reject M. Velpeau's explanation altogether. Besides, the cases observed by Smellie and Delamotte, which he cites in support of his theory, prove nothing at all, for, in both of those instances, the fœtuses were *small and dead, and the woman had, on former occasions, been delivered of voluminous children.*

M. Guillemot has explained the spontaneous termination of the labor in these cases somewhat differently; for when the chin does not rotate in front, the labor, according to his idea, may terminate in two ways, namely: 1st. The forehead continues to descend and to engage under the branch of the pubis until the anterior fontanelle appears at the vulva, which progression permits the chin to advance forward and reach the *border of the perineum;* then the process of flexion commences, &c. But we cannot conceive how, in the forced extension of the head on the thorax, it is possible for the chin to arrive at the anterior perineal commissure by traversing the whole posterior plane of the excavation, because, from all evidence, the breast must engage extensively along with the head, which is wholly impossible, unless it be a case of abortion.

2d. The labor by the face may be converted into one by the vertex and

this always takes place, he continues, in the following manner: the face being forcibly pressed on, and unable to escape through the perineal strait, has a natural tendency to pass towards those points that offer the least resistance. Here, *this condition is found above and behind*, whence the chin leaves the perineum and approaches the fœtal chest by ascending along the hollow of the sacrum towards the sacro-vertebral angle, and the forehead following this movement corresponds to the sacrum in turn; the vertex is depressed and slips behind the pubis, and, just at the moment when the chin applies itself to the child's breast, the occiput engages under the pubic arch. He further supposes the face to be sufficiently engaged for the chin to come in contact with the perineum; but, as we have already stated, this is impossible, on account of the extent of the conjoint diameters of the head and breast, both of which would be deeply engaged in the excavation.

But, even admitting the chin should descend so low, where is the power to make it subsequently rise up in the hollow of the sacrum, the *cavity of which is occupied*, whatever M. Guillemot may say to the contrary, by the deeply engaged breast? For the uterine contraction, which is always transmitted by the spine, acts at first on the chin as a consequence of the reverted position of the head (as M. Velpeau clearly recognized), and it is only because its power is inadequate to make the latter descend any further, that its action is transferred to the other extremity of the fronto-mental diameter, that is, to the forehead, which it then depresses, according to the theory of Guillemot. Again, even supposing that the chin may remount, it is scarcely possible to believe that it gets above the sacro-vertebral angle; it must therefore constantly remain in contact with the anterior surface of the sacrum; and, consequently, at a given moment, the occipito-mental diameter must traverse the antero-posterior one of the excavation.

In my estimation, therefore, we are not to understand this as the true mode by which the mento-posterior positions of the face are converted into occipito-pubic ones; indeed, among all the cases I have been able to consult, I have only found *three* in which the chin was in direct relation with the anterior face of the sacrum, viz., those of Smellie, Delamotte, and Meza (reported by Guillemot).

Now, in the one furnished by Smellie, it is positively stated that the child was *small*, that the woman had a *large pelvis*, and that she was *usually delivered very promptly;* Delamotte says nothing about the head and the dimensions of the pelvis, in his case; and lastly, Meza was obliged to apply the forceps, in the one reported by him; so of course, that was no longer a spontaneous termination, for it would be an easy matter to demonstrate that the application of the forceps may act in an altogether different manner and even more advantageously, than the uterine contraction in this instance; besides, the reader will not forget that, in the first two cases, the children came away dead.

All the other observations may be referred either to the right or the left mento-sacro-iliac positions; and, in these latter, it appears to me that a spontaneous termination of the labor might occur without a simultaneous engagement of the chest and head; for instance, let us suppose that the child is in a right mento-sacro-iliac position; then, after the complete exten-

sion of the head, the face will descend into the excavation as far as the length of the neck permits, and consequently the chin will reach the level of the great sciatic notch, the more so, as the form of this portion of the ilium, which is shaped like a cone, will favor the movement of downward progression. Having arrived at this notch, the chin will there encounter soft parts, which it can very readily depress, and this depression will be quite sufficient to augment the length of the oblique diameter of the excavation from a quarter to half an inch, thereby permitting the occipito-mental diameter to clear it, and the head to undergo the process of flexion, that will gradually bring the occiput under the pubic symphysis.

§ 4. Inclined or Irregular Face Presentations.

The face does not always present so regularly at the superior strait, as to have its fronto-mental circumference parallel to the opening in the pelvis, since the same causes that determine the inclination in vertex presentations, may also render those of the face irregular; and here, likewise, we may invoke the uterine obliquities, the partial obliquity of the child, or an incomplete or an exaggerated extension of its head, to explain how we sometimes find one of the cheeks, and at others the forehead or the chin, at the centre of the upper strait.

But still, these are not to be considered as distinct presentations, but rather as varieties or shades of the face presentations, which scarcely ever render the labor more difficult. In fact, the following is the only modification they are likely to cause in the mechanism of parturition; in the malar positions of Baudelocque, or those inclined towards the side, where one cheek is at the centre, the head undergoes a movement of correction whilst engaging, similar to what it does in the parietal inclinations of the vertex, whereby the face gradually regains its normal horizontal direction. In the so-called presentations of the forehead or chin, the most elevated part becomes depressed, and ultimately gains the same level as the other.

§ 5. Prognosis.

It was for a long time thought, and still is, by some persons, that a delivery by the face cannot take place by the powers of nature alone, and it is only since the labors of Boër, of Chevreul, and Madame Lachapelle, that the expulsion of the child in the face positions has been admitted to be spontaneous nearly as often as it is in the vertex positions.

Nevertheless, we must remark that, as a general rule, the labor is more tedious, more painful, and more dangerous, both to the mother and the child, and that it much oftener demands the intervention of art. Besides, the reflections above presented would naturally lead us to anticipate that the mento-posterior positions are much more unfavorable than the anterior ones. Now, this unusual delay is not because the greatest diameters of the head then present to those of the pelvis, as Capuron and many others supposed: for it is only necessary to bear in mind the relations before indicated, to understand that it is the mento-bregmatic, and the bi-temporal diameters (the one three inches, and the other three inches and three-quarters in length), which are then found to correspond with the diameters of the

straits; but because the dilatation of the os uteri takes place more slowly, and because the expulsive forces, especially in the process of flexion and of disengagement, act, like the arm of a lever which is bent, nearly at a right angle. Moreover, it has already been stated that, in all other than vertex positions, a very large quantity of the amniotic liquid usually existed between the presenting part and the inferior segment of the uterus. We have also remarked (see the *Physiological Phenomena of Labor*), that this circumstance singularly influenced the rapidity of the dilatation of the os uteri. On the other hand, it is also evident that, when the chin is actually engaged under the symphysis, and the process of flexion has already commenced, the force of the contraction transmitted through the spine can only determine the successive disengagement of the forehead, the bregma, and the occiput, by describing a well-marked flexure, and, consequently, thereby losing a large proportion of its force.[1]

Certain authors, says Gardien, have incorrectly supposed that those labors in which the child presents by the forehead are more unfavorable than those where it offers by the face; for, if attention be directed to this point, the head will then he found to present in reality by its favorable diameters; and further, as M. Stoltz remarks, in the face positions, the forehead is already the lowest part, and, the more it descends when the head engages, the more easy will be the labor. Again, the chin presentations are less favorable than those of the forehead, because the child's head is then in the most perfect state of reversion, and, if the shoulders engage at the same time with the vertical diameter of the cranium, a wedging in must inevitably take place in the excavation. But even these, also, soon transform themselves into true face presentations.

As regards the fœtus, the labor, if tedious, may prove very disastrous; since apoplexy, or at least a cerebral plethora, and a disposition to convulsions, are but too often, says Madame Lachapelle, its unfortunate result. The repeated and prolonged compression of the child's neck, a compression which occurs just at the moment when the head is clearing the cervix uteri, or the superior strait, or, still more probably, when the front of the neck is placed under the symphysis pubis, satisfactorily accounts for the difficulty in the return of the venous blood, and the cerebral congestion which it occasions. Consequently, particular attention should be given to the constrained position; for a case that might be abandoned to nature, were the mother alone regarded, would require the intervention of our art, to relieve the fœtus from its painful situation. In cases of this kind, where the face had descended enough to be in full view at the vulva, Madame Lachapelle was in the habit of judging by the movements of the infant's tongue and lips; though it must not be forgotten that these motions are not constant, but, when they do exist, and are found to grow weaker, and finally to disappear, they constitute a bad sign, and claim our immediate attention Furthermore, the child often exhibits certain peculiarities in face deliveries, which ought to be known, in order that the family may be advised of them beforehand. The face corresponds to the open space in the excavation, as also for a long time to the void under the pubic arch; and hence, it becomes affected with the ecchymosis and the sero-sanguineous infiltration before spoken of as happening in vertex presentations.

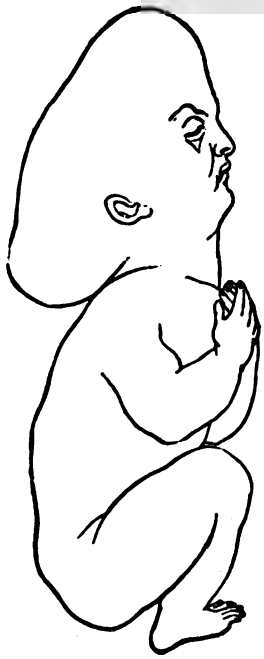


Fig. 3.

Fig. 2.

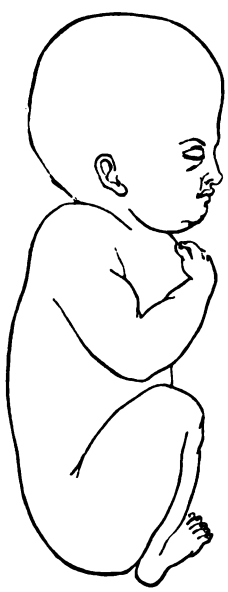


Fig. 4.

Fig. 1.

PLATE VI.

Supplementary diagnosis of the course of labor, from the shape of the skull of the newborn child.
(After Olshausen.)

FIG. 1.

Occipital presentation.

FIG. 2.

Face presentation.

FIG. 3.

Brow presentation.

FIG. 4.

Antero-Frontal presentation.

Consequently, when the labor has been somewhat tedious, the infant's face at birth is nearly black, its cheeks swollen, its lips turned in, and the nose scarcely visible. However, this condition is generally dissipated in the course of a few days, and its resolution may be hastened by the use of lotions. No alarm need be felt about the tendency observed in the head to fall backwards, as soon as the support is withdrawn; for, it only regains the attitude it had temporarily in the pelvis. This feebleness of the muscles of the neck is due to the prolonged extension they have undergone, and ordinarily disappears in the course of two or three days.

Schatz' method of reducing the extended head by external manipulation, as described by Lusk, consists in restoring the normal attitude of the body by flexing the trunk and leaving the head to resume spontaneously its proper position as it sinks into the pelvis. It is performed by seizing the shoulder and breast with the hand through the abdominal walls; then lifting the chest upward and pressing it backward (see diag.), at the same time steadying or raising the breech with the other hand applied near the fundus, so as to make the long axis of the child conform to that of the uterus, and, finally pressing the breech directly downward.*

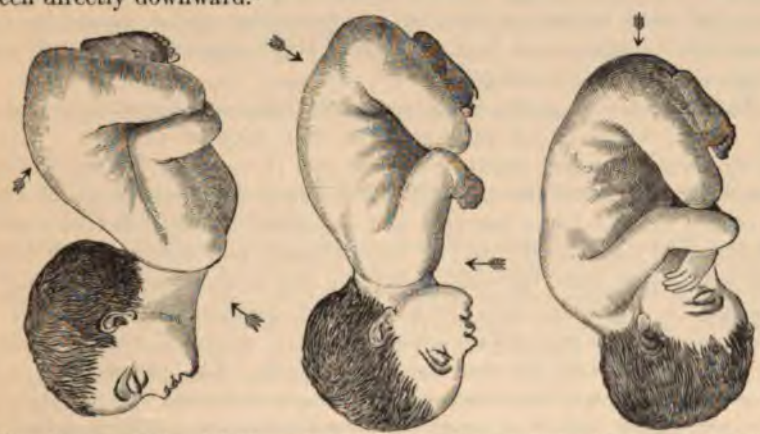


FIG. 81*a*. Diagrams showing Schatz's method of converting face presentations into vertex presentations.

ARTICLE IV.

PRESENTATION OF THE PELVIC EXTREMITY.

We have already had occasion to state that most accoucheurs describe three distinct presentations of the pelvic extremity of the fœtus, to wit, the presentations of the breech, of the feet, and of the knees, according as the breech, the feet, or the knees are the first to engage in the excavation and clear the external parts of generation. We have also explained why (following the example of Madame Lachapelle, Ant. Dubois, P. Dubois, and others) we consider these three as being only slight modifications of the true pelvic presentation; for modifications that do not in any wise change the mechanism of the natural labor ought certainly to be included under one and the same title.

Thus, it may happen, in presentations of the pelvic extremity, that this extremity, composed of all its elements, that is to say, of the thighs flexed on the abdomen, and the legs on the thighs, may engage in the excavation and inferior strait; or that the lower extremities, carried along when the membranes are ruptured, by the gush of the waters, may be completely or partially unfolded; the feet in the former case, and the knees in the latter, appearing first externally; or that, the inferior members being stretched out and applied to the child's anterior plane, the breech alone may descend; or lastly, that one of the lower limbs may be extended up along the abdomen, while the other remains down, and then one foot or one knee, as the case may be, will present at the vulva. We shall include all these varieties under the general name of the *presentation of the pelvic extremity;* and we again repeat that, in the presentations of this extremity, the points of departure, taken on the fœtus, are, the posterior face of the sacrum for the breech; the anterior face of the tibias for the knees; and the heels in the footling cases. With regard to the pelvis, the sacrum, or the back of the child, may be found in relation with any one of the various parts of its superior strait; but still, all these shades of position are included in two principal ones, namely, a first, or left sacro-iliac, and a second, or right sacro-iliac position; and, further, each of these exhibits its anterior, transverse, and posterior varieties.

The presentations of the pelvic extremity are less frequent than those of the vertex, though much more common than those of the face. Thus, in thirty-seven thousand eight hundred and ninety-five labors, Madame Lachapelle has noted one thousand three hundred and ninety of this class; in twenty thousand five hundred and seventeen, Madame Boivin observed six hundred and eleven; and in two thousand and twenty, M. P. Dubois met with eighty-five. In order to give an idea of the relative frequency of the cases in which the nates, the knees, or the feet are first expelled, we will add that, in those eighty-five labors, the nates appeared first at the vulva fifty-four times, and the feet twenty-six times. The presentation of the knees, so called, was not observed in a single instance. In fact, this is a very uncommon variety; for in the thirty-seven thousand eight hundred and ninety-five cases of Madame Lachapelle, the knees came down first only eleven times, or one in three thousand four hundred and forty-five.

In a sum total of sixteen thousand six hundred and fifty-four labors, Dr. Collins has observed the pelvic extremity to offer once in thirty times; and Ramsbotham, Jr., from calculations founded on twenty-seven thousand seven hundred and thirty-nine labors, and twenty-eight thousand and forty-three births, occurring at the Maternity Hospital of London, has arrived at the conclusion that breech presentations are to the others as one to thirty-five. The left sacro-iliac positions are far more frequent than the right; thus, in thirteen hundred and ninety instances, the back looked towards the left side seven hundred and fifty-six times, and to the right, four hundred and ninety-four times; but thirteen times in front, and twenty-six times directly backwards (Lachapelle). In the eighty-five positions of M.

P. Dubois, the back was forty-one times towards the mother's left, and forty-four times to her right. As to the varieties exhibited by these two positions, the left anterior is a little more frequent than the right posterior one, but each of them is far more common than all the others put together. For instance, in one hundred and sixty-three pelvic presentations, says M. Nægèle, the back was in front and to the left one hundred and twenty-one times, whilst it was only forty times behind and to the right.

§ 1. Causes.

It is wholly impossible, in the present state of the science, to say why the breech should sometimes present at the superior strait; true, numerous explanations have been offered, and the following, proposed by Madame Lachapelle and reiterated by Velpeau, is perhaps the least objectionable of any. The child, they say, floats comparatively free in the uterus, until near the eighth month; then its head, during certain movements on the part of the mother, the act of lying down in particular, is carried towards the fundus uteri; and, if the infant has then acquired a considerable volume, perhaps its great occipito-coccygeal diameter cannot repass through the small diameters of the uterine ovoid, without undergoing as forcible a movement as that which changed its position; and if this latter does not occur, the fœtus will retain its new attitude, and at the time of the labor the pelvic extremity will present at the passage. This explanation, I repeat, although liable to many objections, still appears the most probable.

§ 2. Diagnosis.

[Breech presentations may be recognized by the successive employment of palpation, auscultation, and the touch.

Palpation, in accordance with the rules given, will enable us to feel the head at the upper part of the uterus; and, if it can be clearly made out, leaves little doubt as regards the diagnosis. If, however, the walls of the abdomen be thick, or those of the uterus rigid, the cephalic and pelvic extremities may be mistaken for each other, especially if we should happen to feel the latter by its posterior or sacral surface. But moderate importance ought, therefore, to be attached to this kind of exploration, though it is nevertheless true that it has its advantages. We remember a case in which both auscultation and the touch seemed to indicate a vertex presentation, whilst palpation enabled us to feel the head at the fundus of the uterus, and the child was born by the breech.

Auscultation may also enable us to recognize breech presentations, for in this case the dorsal region of the fœtus is pretty high up, and, in consequence, the maximum of the pulsations of the heart are higher than in head presentations. The loudest sound will generally be heard on or above a horizontal line passing through the umbilicus, and the side of the abdomen at which it is perceived will also indicate the point toward which the back is directed. The diagnoses of both presentation and position are thus made at the same time.]

To the foregoing signs may be added the following as distinguishable during labor. The bag of waters is very large, and projects considerably into the upper part of the vagina; sometimes assuming the form of an elongated tumor,[1] which may descend, even to within a short distance of the vulva.

[1] Certain writers have evidently been in error in giving this particular form of the amniotic sac as a positive sign of a presentation of the pelvic extremity, since it may

When the membranes are ruptured, a very considerable quantity of water escapes, for the presenting part fills up the neck but very imperfectly, and hence, all the amniotic liquid flows out; and if the rupture should occur during a strong pain, it would probably be accompanied by a loud report.

Stein described the uterine orifice as being oval after the rupture, and Madame Lachapelle confirmed this sign; but I must confess that I have found great difficulty in verifying it.

A momentary suspension or a diminution of the pains often results from a too copious or a too rapid discharge of the waters; and, further, a flow of meconium most generally takes place soon after the membranes give way.[1]

But the only characteristic signs are those furnished by the touch; and they will vary with the presenting part. Therefore, although we have included, so far as the mechanism is concerned, all the cases in which either the nates, the feet, or the knees present, under one general term; yet, in the diagnosis, we must carefully distinguish them from each other.

1. When the breech alone presents, the finger first encounters a soft, rounded tumor, upon some portion of whose anterior surface a hard, resistant part, formed by the great trochanter of the thigh-bone, is detected. Thus far, it might be mistaken for a vertex presentation; but if the finger be next carried upwards and backwards, so as to reach, as it were, the sagittal suture, it will penetrate into the fissure between the nates, at the bottom of which the most important diagnostic signs are discovered; for the point of the coccyx is felt towards one side, surmounted by an irregular osseous surface, constituted by the posterior face of the sacrum; then the anus, a small, rounded, and wrinkled orifice, into which the finger cannot be introduced without resorting to considerable force, whatever authors may say to the contrary; lastly, the external genital organs can be easily distinguished, and thereby the sex of the child may be announced in advance.[2]

The prominence of the coccyx is not only a certain sign of the presentation, but it may also serve to determine the position; because its point is always directed towards the side not corresponding with the child's back.

be met with in other cases. I have twice observed it myself in clear vertex presentations that were engaged, even then, as far as the middle of the excavation. I can only explain this last circumstance by supposing an extreme laxity of the membranes.

[1] However, a discharge of meconium may take place in other than pelvic presentations; but then it is an alarming sign, and one that should receive the accoucheur's immediate attention. In fact, it always indicates the death, or at least a suffering condition, of the child; and, therefore, will most generally require the intervention of art, since it is particularly apt to come on when the labor has continued a long time after the rupture, and the fœtus is suffering from the protracted delay; or possibly it may announce the compression of the umbilical cord (see *Prolapsus of the Cord*).

[2] The accoucheur ought to be exceedingly careful not to deceive himself on this point; and, in case of any doubt, it would be much better to abstain from all predictions, than to expose himself to an error that would most certainly be retorted upon him afterwards. It is also prudent, where the child is ascertained, by the touch, to be of a sex different from what the family, and more especially from what the mother desires, not to communicate the result of his diagnosis, lest the disappointment she would experience might, like any other acute moral emotion, exercise an unfavorable influence over the progress of her labor.

2. Where the two feet present together in the vagina, it is impossible to confound them with any other part, and the direction of the heels then clearly indicates the child's position. But where a single foot only is detected, and that very high up, it might be mistaken for a hand. However, a little attention will serve to distinguish them; thus the toes are arranged in the same line, are shorter, and less movable; while the fingers are longer and the thumbs separated from the others; the internal border of the foot is much thicker than the external; but the two margins of the hand are very nearly of the same thickness; again, the foot articulates with the leg at a right angle, while the hand continues out the line of the arm.

The diagnosis is very difficult when the feet present along with the nates, and they alone are accessible. Sometimes even only one foot can be felt, which renders the case still more obscure; then we have first to ascertain which is the foot touched; though, for that purpose, it is only necessary to pay attention to the relation existing between its internal border and the heel. For instance, let us suppose that the latter is turned towards the symphysis pubis, and its internal border to the right side of the mother; this is evidently the right foot; if, on the contrary, the heel be directed towards the sacro-vertebral angle, and the internal border to the right, this would be the left foot, &c.; now, the right foot being once distinguished from the left, it only remains to determine towards what part of the superior strait the points of the toes are directed (bearing in mind that we always suppose the inferior extremities to be flexed on the abdomen, and the feet crossed and turned inward). In this position of the child, if the toes of the right foot are turned towards any point of the anterior half of the pelvis, the back will be directed to some part of the left lateral half; but if the toes on the left foot point towards the anterior part of the pelvis, the child's back will look to some point on the right lateral half, and *vice versâ*.

[We think the following the easiest way of distinguishing the right foot from the left one: First, make sure of the position of the toes, heel, and inner edge of the foot in question. Then let the observer imagine his own foot in precisely the same position, with the heel, inner edge, and toes superposed, as it were, upon it. Should his right foot correspond, he will diagnose a right foot, but a left one, should it require the left foot to satisfy the conditions.]

3. The knees very rarely present first; besides, they have such well-marked characteristics in their form, their roundness, their hardness, the size of the limbs attached, and the fold of the ham which surmounts them, a fold presenting a transverse concavity instead of the convexity exhibited at the elbow and instep, that we consider it useless to dilate further upon their diagnosis.

§ 3. Mechanism.

As the left anterior and the right posterior are the most frequent of the three varieties admitted for both the left and the right sacro-iliac positions, we shall select them as the type of our description.

1. *Mechanism of Natural Labor in the Left Anterior Sacro-iliac Position.* (The first, of authors.)

Before the rupture of the membranes, all the parts of the child are folded up along its anterior plane; the head is slightly flexed on the chest, the arms are applied to the sides of the thorax, the fore-arms are bent on the breast, and the inferior members flexed on the front of the abdomen. In the position before us, the back of the fœtus looks forward and to the mother's left; its anterior plane behind and to her right; its left side is in front and to the right, and the right side behind and towards the left; the greater or bis-iliac diameter of its hips corresponds to the right oblique, and its sacro-pubic or antero-posterior one to the left oblique diameter.

[A. *First Stage. Moulding of the Breech.*—The first effect of the contractions is to curve the fœtus upon its anterior plane, and compress the lower extremities upon the breech, so as to mould these parts into a mass small enough to engage in the cavity of the pelvis. The pressure really lessens the size of the breech, and, at the same time, adapts it better to the opening of the superior strait. Although the diminution of bulk is greatest after the membranes are ruptured, the escape of the waters is also liable to be accompanied by an extension of the lower limbs, giving rise to the varieties known as foot and knee presentations, the only effect, however, being to facilitate the descent.

Fig. 82.

The presentation of the breech in the left anterior sacro-iliac position.

This stage is analogous to the first one in vertex presentations; only the diminution of size, in this case, is real and sufficient to allow the breech to descend into the pelvis, whilst in vertex presentations, the slightly compressible head is only enabled to do so by a sort of mechanical artifice, whereby the act of flexion causes it to present the diameters most favorable to its engagement.]

B. *Second Stage. Engagement.*—If the os uteri be freely dilated when the rupture takes place, the nates immediately engage by traversing the cervix, and descend rapidly into the excavation; though, in the contrary case, they remain high up for a long time. In proportion as the contractions acquire more force and energy, the buttocks gradually descend; the left sliding on the internal surface of the obturator foramen and the obturator internus muscle, and the right along in front of the parts that are situated in the left posterior quarter of the pelvis.

C. *Third Stage. Rotation of the Breech.*—Having arrived at the inferior strait, the child's pelvis undergoes a movement of rotation that carries the left hip behind the right ischio-pubic ramus, and the right hip in front of the inner half of the sacro-sciatic ligament. The left or anterior hip next engages under the aforesaid ramus, and is the first to show itself through the vulva; but it is generally the right or posterior hip, which, advancing step by step, and describing an arc of a circle around the anterior one as a centre, and traversing the whole anterior surface of the perineum, first succeeds in disengaging itself at the anterior commissure, while the other remains nearly immovable at the summit of the arch. During the delivery

of the breech, the body of the child, by becoming strongly engaged in the excavation, is flexed laterally on its anterior (left) side in such a way as to accommodate itself to the curvature of the pelvis. (Fig. 84.)

D. *Fourth Stage. Disengagement of the Breech.*—As the right buttock approaches the posterior commissure of the labia externa, and engages in

Fig. 83.

The same position after the internal rotation is accomplished.

Fig. 84

The delivery of the breech.

this opening, the breech, or rather the bis-iliac line of the fœtus, which had already cleared the lower strait in a somewhat diagonal position, now assumes an exactly antero-posterior direction, so as to correspond with that of the longitudinal diameter of the vulva. However, this is not constant, as the breech sometimes retains its diagonal position throughout; the thighs closely applied on the belly already begin to appear, and, pending the disengagement, the fœtal trunk, by accommodating itself, as above stated, to the direction of the pelvic axis, is strongly flexed on its anterior (left) side. The rotation executed by the hips, when they reach the inferior strait, may either be a partial movement, or else one in which the whole trunk participates.

In the former case, it can only take place by the aid of a certain degree of torsion in the lumbar vertebral column, and then the pelvis, immediately after its delivery, undergoes the process of restitution, whereby it once more regains its primitive diagonal position.

As soon as the hips are clear, the breast engages in the excavation, the arms always remaining applied against the anterior lateral parts of the thorax, and the shoulders soon arrive at the inferior strait in an oblique position, supposing they have not previously participated in the rotation performed by the pelvis of the child.

The shoulders observe the same mechanism in disengaging as the hips; that is, they turn in such a manner as to place the anterior one, here the left, behind the right ischio-pubic ramus, and the posterior one just in advance of the left sacro-sciatic ligament, whence they both clear this strait diagonally; but when this is passed, and there is no other resistance than that of the soft parts to overcome, they complete the rotation and

become placed, the one directly in front, the other behind. As to the other parts, the sub-pubic shoulder and elbow are the first to appear externally; but it is still the posterior ones that are first delivered.[1]

Prof. Dubois contends that, in breech deliveries, the anterior hip and the front shoulder, in the disengagement of the upper part of the trunk, are expelled before the corresponding part in the rear; but I may be permitted to repeat again, that, although matters often do occur in the way described by the professor, still it has seemed to me that the view above given holds true in the majority of cases.

E. *Fifth Stage. Rotation of the Head.*—Whilst the shoulders are traversing the pelvis in the manner just indicated, the head, being flexed on the breast, clears the upper strait in the direction of its left oblique diameter; that is, the forehead is turned towards the right sacro-iliac symphysis, and it retains that position until it reaches the inferior strait.

The diameters of the head, which are then found in relation with those of the inferior strait, will necessarily vary according to the greater or less degree of the flexion of the head. For instance, when it is only moderately flexed, which is generally the case, the occipito-frontal diameter corresponds to the left oblique one, the bi-parietal to the right oblique, and the axis of the inferior strait traverses the head very nearly in the direction of its trachelo-bregmatic diameter.

If we suppose the head to be more strongly flexed on the chest, the sub-occipito-bregmatic diameter takes the place of the occipito-frontal, and

Fig. 85.

Delivery by the breech. Disengagement of the head with the chin behind.

the occipito-mental corresponds very nearly to the axis of the inferior strait. In a word, we find the same relations as in a vertex presentation, only the head presents by its base instead of its summit.

It then performs a movement of rotation, whereby the face is carried into the hollow of the sacrum, while the occiput gets *behind*, and the neck under the symphysis pubis; whence the sub-occipito-bregmatic diameter approaches the antero-posterior one very closely, still retaining, however, a certain obliquity.

F. *Sixth Stage. Expulsion of the Head.*—At that time, the womb can act but very feebly on the head (see *Prognosis*), which is altogether down in the vagina, or nearly so; but the tenesmus, says Velpeau, occasioned by its pres-

[1] Many books, on the subject of shoulder-delivery, assert that the arms are retained by the borders of the excavation, and thereby get up alongside of the head; though

sure on the rectum and the bladder, constrains the woman to collect all her powers, and to redouble her courage, and then the contractions of the abdominal muscles soon come to the aid of the powerless womb; these forces, acting conjointly, flex the head more and more, and whilst this process of flexion is going on around the neck or the sub-occipital region as a centre, the chin, the forehead, the bregma, and occiput will be found to appear successively in front of the anterior commissure of the perineum.

During the flexion, the head represents a lever of the first kind, whose power is at the occiput, the fulcrum at the sub-occipital point, or that portion of the neck situated under the arch, and the resistance at the chin, or rather at the forehead, which, being arrested by the perineum, must distend the latter and render it thinner. Hence, if radii be drawn from the sub-occipital point of the head, situated beneath the symphysis, as a centre, and terminating at the median line of the face and vault of the cranium, those radii will exactly represent the diameters which successively clear the antero-posterior one of the inferior strait; the principal of which are the sub-occipito-mental, the sub-occipito-frontal, and the sub-occipito-bregmatic.

2. *Mechanism of Natural Labor in the Right Posterior Sacro-iliac Position.* (Fourth of Baudelocque and third of Capuron.)—In this position, the child's sacrum is turned towards the right sacro-iliac symphysis, its back is behind and to the mother's right, and its anterior plane is to the left, in front; the right side looks forward and to the mother's right, while the left side is behind and towards her left; and the great or bis-iliac diameter of the child's pelvis corresponds to the right oblique diameter.

[Here also the mechanism of the labor may be divided into six stages analogous to those just described for the left sacro-iliac position,—to which the reader is referred in order to avoid repetition.]

Let us suppose, when the membranes are ruptured, that the lower extremities, swept along by the gush of liquid, are completely unfolded, and that the feet present first at the vulva. In this case, the limbs are soon delivered, under the influence of the uterine contractions, without offering any peculiarity, and the hips easily reach the inferior strait, where they engage, sometimes preserving their primitive diagonal position, while at others the anterior one gets slightly in advance towards the symphysis pubis, and the other or posterior goes behind to the median line of the sacrum.

The arms and shoulders present in turn, and their disengagement is nearly the same as in the preceding case.

After the delivery of the shoulders, the head alone remains in the excavation, and its expulsion may take place in several different ways; sometimes, indeed, the occiput remains posteriorly throughout the whole delivery,

as Desormeaux very justly remarked, this scarcely ever happens when the delivery is left entirely to nature, and no traction whatever is made on the pelvic extremity; consequently, when the labor progresses regularly, the accoucheur should overcome the temptation to aid nature a little by drawing on the parts, for such imprudent traction must certainly straighten out the arms, since there is no counteracting power in these cases to press them outwardly; for, being retained by the friction, they remain above the excavation, and the head descends between them, rather than that they mount up on its lateral parts: and fortunate indeed will it be if extension of the head is not produced by these tractions!

though at others, and indeed in the great majority of cases, it comes round in front so as to place itself behind the symphysis pubis.

A. *The Occiput comes in Front.* — This conversion may begin as soon as the hips have cleared the inferior strait; thus it often happens, as before stated, that the whole fœtal trunk participates in the rotation of the haunches, whence the posterior plane of the child, which was primitively situated behind, is brought in front by describing a kind of a spiral, that commences in the hips and terminates at the occiput. The head also has participated in the rotation of the trunk, so that, when the former descends into the excavation, the occiput becomes placed behind the symphysis pubis.

But when the occiput retains its posterior position, after the delivery of the trunk, this rotation of the head may even take place in the pelvis or at the inferior strait. In such cases, after the shoulders are born, the back of the child resumes its posterior direction by a sort of restitution, and the head, remaining alone in the excavation, becomes placed in the direction of the left oblique diameter, the occiput being behind and to the right, and the forehead or bregma towards the mother's left, in front. It then performs a movement of rotation, by which the occiput, after having traversed the whole right lateral half from behind forwards, locates itself behind the

Fig. 86.

Delivery by the breech; disengagement of the head. The chin sliding beneath the pubis, the occiput remaining behind.

symphysis, and the forehead, by rolling from front to rear, is carried into the hollow of the sacrum. . . . . Though, whatever may have been the mode by which this mutation is effected, the labor terminates, just as in the preceding case, as soon as the occiput gets behind the pubic symphysis.

B. *The Occiput remains behind.* — When the occiput remains behind until the end of labor, the delivery of the head may take place in two ways: thus, in the majority of cases, this part engages in the excavation in a state of flexion, where it soon undergoes a very slight movement of rotation, which carries the occiput towards the concavity of the sacrum, and the forehead or bregma behind the symphysis pubis; then, as the uterine contractions and the abdominal muscles force the head to become more and more flexed.

the following parts are found to appear in succession below the symphysis and through the vulva; first the whole face, then the forehead, the bregma, the vertex, and last of all the occiput. The head is therefore delivered by a process of flexion, having the neck, as a centre, resting against the anterior commissure of the perineum. (Fig. 86.)

Finally, it may happen that, instead of remaining applied on the chest, the chin is arrested, and continues above the pubis, while the occiput is carried more and more backwards by a well-marked movement of extension. The head engages in the strait by its occipital extremity, which then traverses the whole posterior part of the excavation by a see-saw movement, and is born first at the perineal commissure; after it come, successively, the vertex, the anterior fontanelle, the forehead, and the entire face. Consequently, the head disengages by a process of extension, having the prætracheloid region as a centre, which is placed at first behind, and then under the symphysis pubis. Cases of this kind are reported by Leroux, Michaelis, and Asdrubali, but they are very rare (Fig. 87).—*The mechanism of labor* in the left transverse, and in the right anterior, and right transverse sacro-iliac positions, is analogous to that just described for the left anterior, and of the right posterior iliac position.

Fig. 87.

Delivery by the breech; the occiput behind, and disengaging at the posterior commissure of the vulva, whilst the chin remains behind the pubis.

[We would observe, however, that the left hip, which in all left sacro-iliac positions ought to appear under the arch of the pubis, turns from right to left in the left anterior sacro-iliac position, and from left to right in the left posterior sacro-iliac-position. The right hip will, in like manner, be found to disengage the first in the right sacro-iliac-position, by turning from left to right in the anterior variety and from right to left in the posterior one.]

§ 4. Prognosis.

Breech presentations are not, usually, much more dangerous than those of the head; still, in order to arrive at an intelligent prognosis, the labor should be studied in reference to its effect upon the mother and upon the child respectively. Though, from the manner of its expulsion alone, the life of the child is seriously endangered, the parturition is certainly less exhausting and less painful for the mother.

1. *As regards the Mother.*—As a whole, the labor is somewhat longer in breech presentations; though, fortunately, the delay is experienced almost exclusively during the first stage, and is the cause of but little additional suffering to the mother. The slowness of the process of dilatation is readily explained by the conditions which have been already pointed out. Before

the membranes are ruptured, the presenting part, having neither the form, roundness, nor regularity of the top of the head, cannot adapt itself to the regular concavity of the inferior segment of the uterus, and being separated from the neck by a considerable amount of amniotic fluid, is therefore incapable of hastening its dilatation. Should the membranes happen to rupture long before the dilatation is completed, the size or irregularity of the breech prevents its engaging readily, and the neck, not being supported as it is by the top of the head in vertex presentations, collapses, and contracts, so to speak, the opening which it had just before presented. In cephalic presentations, on the contrary, the head engages like a wedge, and each expulsive effort tends to increase the dilatation.

When the neck is once thoroughly dilated, the expulsion has always seemed to me to be effected more rapidly than in vertex presentations. The breech, the trunk, and the shoulders are generally delivered with ease, but the head sometimes meets with obstruction, and may be arrested at the superior strait. Generally, however, it is detained for but a short time; for if the efforts of the female are not capable of expelling it, it becomes the duty of the accoucheur to interfere promptly, in order to remove the child from the danger which threatens it. The course to be pursued under these circumstances, exposes the mother to no danger whatever, the entire risk falling upon the fœtus.

As regards the mother, therefore, the breech presentation is perhaps even more favorable than that of the vertex; I would add, that it is certainly more so for her than a face presentation.

It is important to observe, that all the varieties of breech presentation are not equally favorable. Some authors think that the labor is usually longer when the fœtus presents by the breech than when the feet are the first to descend into the excavation.

The size of the parts that constitute the pelvic extremity, it has been said, do not permit it to engage so readily; and hence, the uterine contractions must operate a longer time in order to adapt those parts to the diameter of the pelvis. This is true; but, as Madame Lachapelle has observed, their softness is such that, when once engaged, they easily conform to the passage; and besides, as M. P. Dubois declares, the greater their volume is, the more will the labor resemble that of the vertex presentations. Consequently, the professor teaches, contrary to the opinion generally adopted, that a delivery by the breech is far preferable to that in which the feet come down first: the truth of which proposition will be better understood when we shall have pointed out the inconveniences attending this latter circumstance.

As the footling presentation does not exhibit the same unfavorable appearances in respect to volume, it is preferred by some persons; for then the fœtus, presenting by its smallest extremity, will, in their estimation, be more easily expelled, since the dilatation of the parts, from being slow and gradual, will be much shorter and less painful. If you wish, they say, to drive a cork into the neck of a bottle, you would present its smallest extremity, and then it would enter more readily, and the same is true of the child in the foot presentations; for the fœtal ovoid may be considered as a cone, whose base is at the cephalic, and whose summit is at the pelvic ex-

tremity. In the case of the bottle this is true, but only so, because the efforts you use to make it penetrate, will be redoubled as the larger extremity approaches the neck of the bottle; that is, the force will increase with the difficulties to be overcome; but this last condition does not hold good in the delivery by the feet. Because, as the inferior parts of the child become successively disengaged, there is less left remaining in the uterine cavity, and there is even a period when the head, having reached the excavation, is almost entirely out of the cavity of the cervix; but the uterus, during its evacuation, retracts, and, like all contractile muscles, loses a great portion of its power by this retraction; and it is therefore just at the moment when the great extremity of the cone, represented by the fœtus, has to overcome the resistance of the soft parts, that the uterine contractions are the most enfeebled, and often, indeed, they cannot aid at all in the expulsion of the fœtal head: consequently, the powers here diminish in an inverse ratio to the obstacles in the delivery. If the reader now recalls what takes place in vertex presentations, he will readily comprehend the difference between the two; no doubt, the largest part of the child then presents the first, and its expulsion requires violent and long-continued efforts; but remark that, up to the moment when the head clears the vulva, the uterus yet contains in its cavity a considerable quantity of amniotic liquid, and also the largest part of the fœtal trunk; wherefore, it is still sufficiently distended not to have lost its power of contracting, a power that can be exercised over a large surface, and upon which it is forcibly applied until the end of labor. Again, the head having once reached the exterior, the parts which have been freely dilated by its passage offer but a feeble resistance to the expulsion of the trunk and lower extremities; and hence, the retraction of the womb may diminish its expulsive forces without this diminution having any unfavorable influence over the termination of the labor.

2. *As regards the Child.*—The delivery by the pelvic extremity is very dangerous to the child; thus, the statistical results furnished by Madame Lachapelle prove that, in eight hundred and four presentations of this class, one hundred and two children are born feeble, and one hundred and fifteen are still-born: the proportion of deaths to the whole being rather more than one-seventh; whilst, in twenty-six thousand six hundred and ninety-eight vertex positions, there were only six hundred and sixty-eight still-born children, which gives one in thirty, or about one-thirtieth. As to the particular prognosis in each of the three varieties of this presentation, it has been remarked that, when the buttocks advance first, the number of deaths is about one in eight and a half, or a little less than an eighth; for footling presentations, one in six and a half, rather less than one-sixth; and for the knees, one in four and a half, or not quite one-fourth. But M. P. Dubois has justly remarked that this proportion is not perfectly correct, since all the children born by the pelvic extremity are included in the registers of the Maternity, without making any allowance for circumstances foreign to the position, but which nevertheless may have produced the child's death. Therefore, by laying aside all the cases where the children seemed to have been lost under the influence of causes that evidently did not attach to the presentation itself, he has arrived at the conclusion that, in delivery by the pelvic extremity, about one child in eleven dies;

whilst in vertex presentations, only one in every fifty proved fatal. The difference still, as here shown, is frightful.

Other things being equal, the labor is much more dangerous for the fœtus in primiparæ, than in those who have previously borne children; because the resistance of the perineum which is sometimes sufficient in the former to arrest the labor, even in vertex presentations, has here a still greater tendency to arrest the head, the uterine contractions, as just demonstrated, being weaker.

But what is the cause of the child's death? For a long time it was supposed that, when the fœtus presented its smallest extremity, each part, as it came down, being more voluminous than the one which preceded it, had to overcome new resistances; that it underwent, in consequence, a certain amount of compression, and this compression, being exercised from below upwards, would necessarily drive back the fluids, and thus give rise to a cerebral congestion, the anatomical signs of which are detected at the autopsy of the little corpse. But this supposed pressing back of the fluids is altogether inadmissible: 1st. Because the uterine neck is alternately in a state of relaxation and constriction, whilst such an explanation would require it to be permanently contracted; 2d. Because, however great the contraction, it would not be sufficient to compress the large vessels situated deep in the extremities, and in the centre of the great cavities; 3d. Besides, by recalling what takes place in the vertex and face presentations, we shall see that it is not in the parts which are still contained in, and compressed by, the uterine cavity, that a more considerable afflux of fluid would be likely to occur, but rather in those which, from being already free, are thereby relieved from all further compression. We think this mortal congestion can be explained in a much more satisfactory manner by a compression of the cord; for, after the breech is disengaged, the cord is stretched from the umbilicus to its placental insertion, and is placed, both in the excavation and uterine cavity, between the pelvic wall and the trunk, or even, a little later, betwixt this wall and the child's head. Hence, we can easily understand how liable it is to be compressed; and as the delivery of the upper parts, and more especially of the head, often takes place with difficulty, how this pressure may exist for a long time, and thus necessarily interrupt the circulation in the cord. Indeed, it is now generally admitted that the placenta is the seat of the child's respiration; or, rather, that the blood of the fœtus comes there directly into contact with that of the mother, whereby it experiences certain modifications closely analogous to those which the blood of the adult undergoes in the lungs, by its contact with the atmospheric air; the circulation being interrupted in the cord, the fœtus then finds itself in the condition of an adult deprived of respirable air, and it dies asphyxiated; now it is well known that cerebral congestion is one of the most constant anatomical phenomena of this state.[1] I am of the opinion

[1] Most of the older writers have explained the child's death somewhat differently, in these cases; thus, according to some, the pressure interrupts the circulation in the umbilical arteries, but leaves the calibre of the vein entirely free, whence the fœtus continues to receive blood through the latter, without being able to send it back again by the former; and it then dies from a superabundance of this fluid, from apoplexy. Others, on the contrary, supposed that the stricture acted more particularly upon the vein, leaving the arteries free, and therefore that the infant died of anæmia or syncope

that asphyxia of the fœtus might take place in still another manner, and yet without the cord being necessarily compressed. It was stated above, that, when the head gets down into the excavation, no portion of the child is left in the uterine cavity, and the empty womb then retracts of its own accord; which retraction determines, as is well known, the separation of the placenta, whereby the utero-placental vessels are inevitably torn, and the fœtus placed in the same condition as if the cord was compressed, and, should the expulsion of the head be at all delayed, it might die asphyxiated.

It is not necessary, however, that the placenta should be separated in order to produce this effect; for, as Van-Huevel remarks, if the head be retained for some time in the cavity of the pelvis, the retraction of the womb would of itself obstruct, or even stop the utero-placental circulation, and destroy the fœtus by asphyxia.

ARTICLE V.

PRESENTATION OF THE TRUNK.

At the commencement of this chapter, we gave the reasons that induced us, like Madame Lachapelle, Nægèle, and Dubois, to admit but two presentations for the trunk, and therefore shall not now repeat them; for, doubtless, the reader will bear in mind that all the varieties of the trunk presentations may be referred to the two following, namely, one of the right and one of the left lateral plane.

When the former presents at the superior strait, the child's head, which, in these cases, is taken as the point of recognition, may be found placed over some portion of the left lateral half of the pelvis, and this constitutes the first position of the right lateral plane (or of the right shoulder, Lachapelle); or, the head may be situated over some point of the right lateral half, and this is the second position. We have, therefore, two positions of the right shoulder, or right lateral plane; and, in the same way, there are two for the left shoulder, or left lateral plane; in the one, the head is to the mother's left (the left cephalo-iliac), and in the other it is at her right (the right cephalo-iliac).

It is a very common circumstance in trunk presentations, to find the arm and hand hanging down in the vagina, or even the latter appearing at the vulva. This, although regarded for a long while as a much more serious affair than a proper shoulder presentation, should be considered as very nearly similar in its character to the deflexion of the lower extremities in certain cases of pelvic presentation; the older accoucheurs have therefore erred in describing it as a distinct variety, under the title of the presentation of the arm and hand, it being merely an additional phenomenon associated with the presentation of the child's lateral region, and scarcely deserving consideration as a variety of these positions; we shall see, further on, wherein they were mistaken on this point of doctrine.

Neither of these theories will bear the slightest examination, since it is all-sufficient to examine the cord, and the intertwining of its vessels, to be convinced that this partial compression cannot exist, except under peculiar circumstances; that such pressure must interrupt the circulation, both in the arteries and veins, and that it neither augments nor diminishes the quantity of the child's blood. Death by asphyxia, therefore, is the only possible mode.

The trunk presentations are comparatively rare, being a little less so, however, than those of the face; thus, Madame Lachapelle met with sixty-eight cases in fifteen thousand six hundred and-fifty two labors, or one in about two hundred and thirty; and, in the two thousand two hundred deliveries reported by M. P. Dubois, there were thirteen trunk presentations. Dr. Bland observed it in the proportion of one to two hundred and ten; Dr. Joseph Clark, one in two hundred and twelve; Merriman, one in two hundred and fifty-five, in his private practice; M. Nægèle, one in one hundred and eighty; and Dr. Collins, one in four hundred and sixteen.

As to the relative frequency of the presentations and positions, it would appear, from the statistical tables of Madame Lachapelle, that the right shoulder, or the right lateral plane, presents a little more frequently than the left; and that the dorso-anterior positions, that is, the first one of the right shoulder, and the second of the left, in which the back corresponds to the anterior part of the uterus, are more frequent than the dorso-posterior positions, or the first one of the left and the second one of the right shoulder, where the child's back is directed towards the mother's loins. (Nægèle.)

§ 1. Causes.

We have but little to say concerning the cause of trunk presentations, excepting that the smallness and mobility of the child, a rounded form of the uterus produced by a large amount of amniotic fluid, obliquity of the womb, or of the straits of the pelvis, and distortions of the superior strait, are generally regarded as predisposing thereto. We can readily understand that, in the latter case, the contraction of the pelvic entrance might render the engagement of the head impossible, and by causing it to glide toward one of the iliac fossæ, favor a presentation of the shoulder. The insertion of the placenta upon the neck of the uterus, also, seems to predispose to presentations of the trunk, inasmuch as out of ninety cases of this character, there were twenty-one in which the shoulder presented. M. Danyau thinks that a more plausible explanation may be found in the shape of the uterus, whose transverse diameters he supposes to be greater under those circumstances than usual. In support of his view, he alleges the following case of Dr. Lecluyse. A woman had her children to present the shoulder in three successive labors, and on the third occasion, the latter physician discovered that the womb, so far from being pyriform in the vertical direction, was shaped, so to speak, like an ellipsoid, whose major axis was transverse, whilst the fundus of the organ was but slightly elevated above the pubis.

The same explanation was proposed long ago by Wigand. How is it possible, says he, for a well-formed child, whose body represents an oval, to assume, without being compressed or incommoded, an oblique or transverse position, in a womb of an ovoid shape? Supposing that, impelled by certain causes, it should assume these defective positions for a moment, what magical power could keep there a fœtus, whose mobility is so highly favored both by the fluid in which it swims, and the polish of the internal surface of the ovum? What is there to prevent it, in obedience to physical laws, from changing its inconvenient position by bringing its long diameter to coincide with the longitudinal one of the uterus? No better reply, he adds

can be given to these questions, than by admitting that these defective positions are due to an irregular shape of the womb, rather than to the movements which it may have performed.

Remembering the unfortunate perseverance with which defective positions recur in the cases of certain females, there is a strong disposition to seek for the cause in a peculiar shape of the uterus; and had a peculiar conformation of the organ been discovered before the first gestation, it might, perhaps, be admitted, that notwithstanding the development undergone during pregnancy, the irregularity of shape would be preserved.

Still, we may be allowed to ask whether the increase in size transversely, near the end of gestation and at the beginning of labor, may not be the effect rather than the cause of the unfavorable position of the fœtus.

As to the determining causes, the only ones recognizable are fortuitous and accidental; thus, any violent commotion, any trifling shocks, kept up for a long time, such as those produced by carriage riding, or by exercise on horseback, the perturbation from the upsetting of a coach, and even sudden fright, may change, according to authors, the child's position in certain cases, and convert spontaneously a vertex presentation into one of the shoulder. Indeed, many accoucheurs have supposed that irregular or partial contractions might convert, during labor, a favorable position in one of the trunk; this is barely possible. But I cannot as readily admit the supposed influence which, according to some others, those uterine contractions may have, that torment the woman during the last few days, or sometimes even weeks of her gestation, and which have before been considered as the preludes of labor. The following is a case in point: A patient, in whom the fœtus presented by the shoulder five times successively, had always suffered from these pains during the last few days of her pregnancies; Professor Nægèle, under whose care she came on the sixth accasion, endeavored this time to calm the pains, which again appeared with the same energy as in the preceding gestations. After the ineffectual administration of various remedies, he finally ordered opiate injections, when, to his great satisfaction, the spasms ceased almost immediately, and were not again renewed, and the woman was delivered at full term of a living child, which presented in a favorable position. But what does this prove? simply that, whatever may be the child's position, these pains, the preludes of labor, may appear, and that vicious positions may be reproduced in the same woman with a most deplorable perseverance. It must be evident that such contractions are too feeble to change the child's position in any way, especially when we remember that the integrity of the amniotic sac, and the presence of the waters, likewise protect it from any influence they might have.

§ 2. Diagnosis.

There is sometimes reason to suspect a trunk presentation, even before the commencement of labor, from the following signs: the abdomen is much larger in its transverse diameter than usual, and when its walls are soft and flabby, they can often be depressed enough to detect the fœtal head in one of the iliac fossæ, presenting there as a hard, rounded, and resistant tumor; then by placing the hands opposite each other in the lumbar regions, a

greater and firmer resistance offered by the two extremities of the fœtal ovoid will be felt at these points, and the solid body, formed by the child, may be readily moved from side to side, thus proving that its long axis lies transversely above the superior strait. Finally, the tumor formed by the head, in the vertex presentations, is no longer detected by the vaginal touch, and it is almost impossible to reach the presenting part; in some rare instances, the elbow, or the little hand of the child, may be recognized and ballotted, and this sign, accompanied by the first two, renders the diagnosis quite probable.

The form of the abdomen is then very irregular, especially if the uterus should contain but a small quantity of amniotic fluid. It has, however, been observed, that after the discharge of the waters, the longitudinal diameter gradually becomes greater than the other; because, as M. Hergott remarks, the transverse position has no longer a real existence, for the body of the fœtus is so curved upon itself that one of its extremities is lodged in the fundus of the uterus, although the other does not correspond to its orifice.

[Although the use of auscultation in breech presentations is but of doubtful advantage, M. Depaul thinks that it may enable one to arrive at a correct diagnosis when the back of the fœtus is directed forward. In this case, he says, everything is arranged favorably for the recognition of the maximum intensity of the sound, which will be found at the anterior part of the lower segment of the uterus as in head presentations. In proportion, however, as the position assumes a transverse direction, the difference becomes much more decided, inasmuch as the sound, instead of being heard in a lessening degree toward the fundus of the womb, then extends in an almost horizontal direction, from one iliac fossa to the other, for example, and will be absent from a large portion of the upper region of the organ.]

Though M. Depaul's opinion is rational and founded on fact, it is none the less true that trunk presentations would almost always remain undetected if we had to depend upon auscultation for their recognition.

Sometimes, however, it may prove a useful auxiliary. If, for example, a small member of the fœtus be detected by the touch, and the pulsations of the heart are heard in the hypogastric region, we may conclude almost certainly that the member belongs to the upper extremity. Should the heart be heard on a level with the umbilicus, it would most probably prove a pelvic extremity.

Before the membranes are ruptured, the elevation of the part renders the vaginal touch very difficult; and so, of course, the form of the bag of waters, or that of the uterine orifice, can be of but little service. According to Madame Boivin, the os uteri dilates more slowly, but as this slowness of dilatation is met with in all presentations, excepting those of the vertex, it forms a sign of minor importance; the touch, therefore, can only give a positive certainty after the rupture of the membranes. When the side is the presenting part, the shoulder (Lachapelle) is very frequently found at the centre of the superior strait, as also the elbow, or the side of the chest (P. Dubois), and hence will be the first encountered by the finger in making an examination; and we therefore have to point out the characters, successively, whereby these several parts may be recognized.

1. When the shoulder presents, the finger first detects the rounded tumor formed by its summit, upon the surface of which a small osseous projection, constituted by the acromion, is distinguished; then, behind or in front, according to the position, the clavicle and the spine of the scapula are felt, and below the clavicle the intercostal spaces are easily made out, whilst under the spine of the scapula there is only a plane surface, terminated by the acute inferior angle of this bone, which is movable and permits the finger to slip under it; lastly, on the sides of the tumor formed by the shoulder, the axillary space can always be distinguished, and sometimes also (though on the opposite side) the depression in the neck can be felt.

The shoulder being once recognized, we must next determine which one it is, and what is its position. I will remark, in advance, that we have admitted but four positions of the trunk, namely, two for the right shoulder and two for the left, and that the relation existing between the situation of the head and that of the child's posterior plane is different in each of these four. Thus, there are two positions where the head is to the left, namely, the first position of the right and the first of the left shoulder; and remark that, in the latter, the child's back is turned towards the mother's loins; in the former, on the contrary, it is in front; and, therefore, whenever the head is to the left and the child's back is behind, we have to treat with a first position of the left shoulder.

In the same way, there are two positions in which the head is to the right, to wit, the second of the right and the second of the left shoulder; but again observe, that in the latter the back looks forwards, while in the former, on the contrary, it is directed posteriorly. Hence, to recognize a second position of the left shoulder, it will only be necessary to ascertain that the child's head is turned towards the mother's right side, and that its back looks anteriorly. In a word, to satisfy ourselves which is the presenting shoulder, and what is its position, we only have to find out where the head lies, and the position of the posterior plane of the child.

The shoulder presenting and being recognized, it is evident that if the axillary space looks towards the mother's right, the head will be to her left, and *vice versa;* consequently, the situation of the head is readily known by the direction of this space, and, as regards the child's dorsal plane, the omoplate will clearly indicate its position.

2. When the elbow alone is accessible to the finger, it may be recognized by the three osseous projections (the olecranon and the two condyles), which it presents by the transverse concavity in the bend of the elbow, and by the vicinity of the chest and intercostal spaces. The elbow having been distinguished, it will be necessary to make out the position to ascertain where the fœtal head and its dorsal plane lie, but this is now comparatively easy, since the elbow is always directed towards the side opposite to that where the head is found, and the forearm is always placed on the anterior plane.

Again, as above stated, it happens at times that the forearm is not doubled up, but that, on the contrary, the hand hangs down in the vagina, or even appears at the vulva. Now, to determine which is the presenting hand in those cases, it is necessary to turn it in such a way as to place its palmar

surface in front and above, for, in this position, if the thumb be directed to the mother's right thigh, it is the right hand, but if to the left thigh, it is the left hand; and then, to find out where the head is, the accoucheur must slip his finger up to the axillary space.

[The advice just given would enable us to recognize with certainty the projecting hand; the misfortune is that it is so easily forgotten. Therefore we think it better that the operator should simply observe which of his own hands would fulfil precisely the conditions of that of the fœtus as to position, for then the diagnosis would be just as certain, inasmuch as, with the exception of the size, the right hand of an adult is formed precisely like the right hand of the child, and so with the left hands of both, whilst marked differences exist in the reciprocal arrangement of the parts composing a right hand and a left one.]

When the hand comes out at the vulva, a careful inspection of it will most generally be sufficient to establish the diagnosis. Thus, if its dorsal surface is turned towards the patient's right thigh, the head is at the right, and if to the left thigh, the head is at the left. The little finger, directed towards the coccyx, indicates that the child's dorsal plane corresponds to the mother's loins, and the same finger pointing to the pubis, is an evidence of this plane being in front.

We have been thus particular in the diagnosis, because it is all-important in trunk presentations to understand clearly which side presents at the strait, since the accoucheur must always endeavor to turn; and if the details just given prove difficult of comprehension from a single reading, we hope they will become clearer by practising on a mannikin.

§ 3. Mechanism.

When the trunk presents at the superior strait, the labor nearly always requires the intervention of art; though, in some rare cases, which may be considered as altogether exceptional, nature alone is adequate to accomplish the delivery, which may then take place in one or two ways; for either the presenting shoulder is driven from the superior strait under the influence of the uterine contractions alone, to make room for one of the child's extremities, thereby producing a change in position, and giving rise to what is designated as *spontaneous version*, or else the presenting shoulder descends into the excavation and engages at the inferior strait; notwithstanding which, the breech sweeps along the whole anterior surface of the sacrum and of the perineum, and is delivered the first at the posterior vulvar commissure; this latter mechanism is called *spontaneous evolution*.

1. *Spontaneous Version.*—Where the membranes are not ruptured, though the labor has actually commenced, the fœtus sometimes enjoys a great latitude of motion in the amniotic cavity, in consequence of which it might, in such cases, readily change its position before the discharge of the waters took place; and it has been known to present, in this way, different points of its surface during the first period of the labor. Sometimes the head ascends in the womb while the breech descends; at others, on the contrary, the nates mount up towards the fundus uteri, and the head becomes located at the superior strait. Consequently, two varieties of spontaneous version have been admitted, *i. e.*, the *cephalic* and the *pelvic*.

This phenomenon usually occurs either just before or else soon after the membranes are ruptured; in some instances, however, it takes place a long time after the waters are discharged. The following case, reported by M. Velpeau, will give a very correct idea of what occurs under such circumstances: "A young woman, pregnant for the second time, came into the hospital at ten o'clock in the morning. The os uteri was very little dilated; nevertheless, I could recognize a second position of the left shoulder. The waters did not escape until three in the afternoon, and I did not wish to go after the feet, as the pains were neither very strong nor very frequent, and I had some confidence in the assertions of Denman on this subject. At eight o'clock in the evening, the shoulder had sensibly moved towards the left iliac fossa, and I could then readily detect the ear at the right. At eleven, the temple had almost gained the centre of the orifice; the contractions were augmented in energy; and the cervix was entirely effaced. At midnight, the vertex had become lower; the head engaged; and, in the course of an hour, the vertex was delivered in the right occipito-cotyloid position."[1]

This case, in which the progress of the labor has been followed and described, step by step, is well suited for explaining the mechanism of spontaneous cephalic version. The reader will easily comprehend that the same phenomena would take place, if the breech, instead of the head, descended towards the superior strait; and, in the above instance, for example, the shoulder, instead of being driven towards the left iliac fossa, would be forced to the mother's right, and then the side of the chest, the loins, the left hip and thigh, would successively appear at the upper strait, and the breech finally engage in the excavation.

In a shoulder presentation, the arm and hand may hang down in the vagina, or even protrude beyond the vulva; but this last circumstance does not preclude the possibility of a spontaneous version, only it is well to bear in mind that the arm may then ascend again into the uterine cavity, and this will almost certainly happen if the pelvic extremity descends into the excavation, but it may also lodge on one side of the pelvis, and thus permit the head to descend alongside of it; the presentation of the cephalic extremity being then complicated by a procidentia of the arm and hand. In the present state of our science, it would be a very difficult matter indeed to point out the various causes, under the influence of which it is sometimes the head, and sometimes the breech, which thus, in cases of spontaneous version, take the place previously occupied by the shoulder, at the superior strait. Nevertheless, I am inclined to believe that irregularity of the uterine contractions is not wholly foreign to such an effect. In fact, when we shall speak hereafter of what the German accoucheurs have

[1] With regard to the case in the text, I may say briefly, that the course of M. Velpeau was legitimized by the desire he had of testing the opinions at that time (1825) in dispute; but young practitioners should be very cautions how they make such experiments; for although, in the hands of a man like Velpeau, the version, at an advanced period of labor, would have been comparatively easy, yet it must never be forgotten that, in trunk presentations, the soonest possible period after the rupture of the membranes is the most favorable for the artificial version.

described under the name of *Partial Contraction of the Womb,* it will be seen that, in some cases, the organ appears to contract in but a limited part of its extent, the remainder contracting with much less force, or even perhaps remaining entirely inert. Now, without being able to cite a single instance in support of my opinion, I am strongly inclined to believe, that it is in such a condition of the uterine walls that spontaneous version would be the most likely to take place. Let us suppose, for example, that when the child is placed in a left cephalo-iliac position of the right shoulder, the left side of the uterus alone contracts, the right remaining passive; it is manifest that the whole expulsory effort, being then exercised on the head, would necessarily depress it towards the centre of the superior strait; and this movement of the cephalic extremity will be easy, in proportion as the inertia of the right lateral wall of the womb shall oppose no obstacle to the elevation of the pelvic extremity. But if, on the contrary, (in the same position of the child), the right side of the womb only contracted, it is evident the breech alone would receive the impulse from the uterine efforts, and then a spontaneous podalic version would be observed to take place.[1]

2. *Spontaneous Evolution.*—The mechanism of spontaneous evolution is much better understood, and we shall find embraced in its descriptions all the divisions of the mechanism of natural labor in the vertex and face presentations. Here, also, M. Velpeau has admitted two varieties, that is, a spontaneous cephalic, and a spontaneous pelvic evolution. But we cannot conceive how a spontaneous cephalic one can take place, unless it be in cases of abortion, or in those where the child is completely putrefied; hence we shall treat of the pelvic variety alone, taking, as an example, the first or left cephalo-iliac position of the right shoulder, in which the child's head is placed in the left iliac fossa, the breech in the right iliac fossa; the dorsal plane being in front, and the sternal one behind, and the long axis situated very nearly in the direction of the transverse diameter of the upper strait.

Under such circumstances nearly all the waters escape immediately after the membranes are ruptured; then the uterus contracts forcibly, and by compressing the fœtal trunk on all sides, has a tendency to make the presenting part engage in the excavation.

A. *First Stage. Doubling up of the Child.*—Under the influence of the uterine contractions, the child is strongly bent in the direction of its long axis towards the side opposite to the presenting one; for instance, in the case before us, the head is bent to the left side, and the breech towards the hip of the same side.

B. *Second Stage. Engagement.*—A second stage, the period of *descent,* then sets in; that is to say, in proportion as the contractions are renewed, the shoulder approaches more and more towards the inferior strait, and the fœtal trunk, being bent double, engages deeply in the excavation. But the same difficulty is here met with as in the face presentations (see *Positions of the Face*); that is, the body being thus placed transversely, it is impossible for the shoulder to reach the lower strait unless the head engages simultaneously with it in the excavation; or, indeed, unless the neck should

[1] Taylor (Am. Jour. of Ob., July, 1881) uses the word *retraction* to describe the physiological motive power or action of the uterus, which takes place after contraction and during the relaxation by which the shoulder of the child, or any other part, is lifted or drawn up or back from its position in the pelvis.

be long enough to subtend the height of the lateral wall of the latter, which we have already seen is impossible (see *Mechanism of Face Positions*). The descent of the shoulder is therefore limited to the length of the neck.

C. *Third Stage. Rotation.*—A movement of *rotation* next occurs, by

FIG. 88.

First position of the right shoulder with the arm hanging down.

FIG. 89.

The same position during the descent.

which the long axis of the child, that was originally placed transversely, is brought very nearly into an antero-posterior direction, so that its cephalic extremity is placed above the horizontal branch of the pubis close to the spine of that bone, and the breech above, or rather in front of the sacro-iliac symphysis. This process of rotation being once effected, the descent may now be completed, since the side of the neck is placed behind the symphysis pubis, whose whole length it can subtend; consequently, the forearm and arm are found to appear at the vulva, and the shoulder to get under the arch of the pubis.

D. *Fourth Stage. Disengagement of the Trunk.*—The trunk, being now bent double, is forced *en masse* into the excavation, under the influence of the powerful uterine contractions, but the shoulder can descend no further, because it is arrested by the shortness of the neck; hence, the expulsive force acts on the pelvic extremity, which is pressed more and more towards the floor of the pelvis, and traverses the whole anterior face of the sacrum. It then rests against, depresses, and forcibly distends the perineum; the vulva soon dilates, and the *acromion remaining always fixed under the symphysis*, the following parts are observed to appear successively at the anterior perineal commissure: first, the superior lateral parts of the chest; next, its inferior part, the loins, the hip, the thighs; and lastly, the whole length of the inferior extremities; and there remain only the head and the left shoulder in the excavation. This last movement may be considered as the fourth stage of the labor, and it is therefore named the period of *deflexion* or disengagement. It takes place around the shoulder, situated under the symphysis as a centre, and therefore, if lines be drawn from this centre, terminating at the various points on the child's side, we shall have all the radii, or the fœtal diameters, which clear the antero-posterior one of the inferior strait.

[E. *Fifth Stage. Rotation of the Head.*—When by spontaneous evolution the body has been disengaged, the conditions have become the same as in breech presentations In the fifth stage, therefore, the head rotates so as to bring the occiput behind the symphysis pubis.

F. *Sixth Stage. Expulsion of the Head.*—In the last stage the head is delivered as in breech cases.]

Such is the exact mechanism of the spontaneous evolution in those cases where the child's posterior plane was originally in front; or, in other words,

Fig. 90.

Fig. 91.

Fig. 90. Position of the child after the rotation. and just at the moment when the process of disengagement begins.

Fig. 91. The same position with the delivery more advanced.

in a first position of the right or a second of the left shoulder, for there is no difference in this last, excepting that the movement of rotation must take place in the opposite direction, that is, the head must pass from right to left and from behind forward, and the breech from left to right and from before backwards. But when the sternal plane of the fœtus is primitively directed towards the mother's front, as in the first position of the left, and the second one of the right shoulder, the process takes place somewhat differently. M. P. Dubois, who had an opportunity of seeing two cases of this nature, informed me that, at the moment when the breech disengaged at the anterior perineal commissure, the child's whole trunk underwent a movement of torsion that again brought its dorsal plane forwards and upwards, which plane, without this process of torsion, would still have been directed towards the anus; whence we find, even here, remarkable as it may seem, the influence of that general law which was observed to regulate all natural labors, namely, that, *whatever may have been the original relations of the child's posterior plane, it ultimately comes into correspondence with the anterior parts of the pelvis.*

A variety of spontaneous evolution is described by Röderer as "*evolutio conduplicato corpore,*" in which the trunk is so greatly flexed that the head and thorax enter the pelvic cavity simultaneously, and are expelled followed by the breech and legs. This occurs most frequently in those cases in which the fœtus has been softened by putrefactive changes. Dr. Taylor

Plate VII.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 5.

Fig. 4.

Caseaux *Obstetrics.*

PLATE VII.

FIGS. 1–4.

The different stages of Spontaneous Expulsion.
(After Spiegelberg.)

FIG. 5.

Labor with the body bent double.
(After Kleinwachter.)

advises the division of the perineum freely and laterally, to the extent of three or four inches, to allow the breech to be delivered, and thus avoid the sacrifice of the child if living.

§ 4. PROGNOSIS.

We again repeat, for it seems highly important that this should be firmly impressed on the mind, that in trunk presentations a spontaneous expulsion of the child is wholly an exception to the general rule, and one upon which no reliance can be placed, unless in a case of abortion; and that the resources of our art are demanded in every case just as soon as the necessary conditions exist for such intervention. (See *Version.*)

In fact, by consulting the published cases, or indeed by simply reflecting on the mechanism by which the delivery is effected, we realize how this must expose the woman to a very long and painful labor, and the fœtus to so violent a compression that its death must often result in consequence. According to the statistics furnished by M. Velpeau, one hundred and twenty-five children, in one hundred and thirty-seven, were still-born. It must not be supposed, however, as some persons appear to have done, that this mode of delivery is only possible in cases of abortion; for facts too numerous militate against this opinion for it to be any longer tenable.

Burns justly remarks, in endeavoring to demonstrate the physical possibility, that the greatest diameter measures five inches and a half; sometimes the distance is barely five inches, and continued force may make it less; hence, provided the dimensions of the pelvis are slightly greater than in their normal condition, there is nothing here physically impossible, as has been affirmed and reaffirmed, doubtless without mature reflection. The favoring circumstances which render a spontaneous evolution easier and more likely to take place are: a premature labor, the smallness of the child, a large pelvis, strong contractions, diminished resistance from the soft parts, numerous antecedent labors, and the readiness with which the woman has heretofore been delivered of large-sized children. The opposite circumstances would render it exceedingly difficult, if not wholly impossible.

ARTICLE VI.

REVIEW OF THE MECHANISM OF LABOR IN GENERAL.

A curious fact in the mechanism of labor, and one which has claimed the attention of all modern accoucheurs, amongst whom we may mention especially MM. Dubois and Jacquemier, is, that whatever the presentation may be, the movements undergone by the fœtus during its expulsion are always the same. Finally, Professor Pajot made a clear statement of this single mechanical law, and applied it to all the presentations. "We maintain," he says, "that all labors, so far as the mechanical phenomena which they present are concerned, are governed by the same law. *There is, in fact, but one mechanism of labor, whatever the presentation and position may be,* provided the expulsion takes place spontaneously, that is to say, without the intervention of art and at term, for in cases of abortion the expulsion is not of the regular character." (Pajot, *Dictionnaire Encyclopédique des Science. Médicales.*)

We accept fully this view of the subject, and repeat that all spontaneous labors obey the same law as respects their mechanism. The presenting part of the fœtus is first modified, as to its size or direction, in order to adopt it to the opening of the superior strait; then it descends into the cavity of the pelvis, and having reached the inferior strait turns, so as to present its longer diameters to the longer diameters of the pelvis, and not until it has undergone this series of movements is the vulva cleared and the expulsion complete.

We have thought that the transition would be easier from this simplicity of facts to the region of theory, if the classification of the different stages of labor were somewhat modified. Although the most recent classifications are wonderfully simplified, they still fall short of entire uniformity, presenting here and there some omissions and a few contradictions. For instance, in deliveries by the vertex or face five stages are described, the first four of which are really executed by the head, then the rotation of the body is described as the fifth and last time, without considering its final expulsion, which is merely mentioned. The disengagement of the body being thus disregarded, students are liable to forget an important cause of dystocia described by Jacquemier, viz., the large size of the shoulders. In cases of delivery by the head, a fifth stage, that of rotation of the body, is described, why, therefore, not be logical throughout and admit a sixth stage for its expulsion?

In breech labors, four or even five stages are commonly described. It is well, indeed, to recognize, as do MM. Dubois and Pajot, a first stage for the diminution in size and modelling of the presenting part; then the engagement, rotation, and expulsion of the body will correspond with the second, third, and fourth stages. Up to this point there is entire uniformity between labors by the head and breech, but for the fifth stage in breech cases we have a confused account of the internal rotation of the head and its final expulsion. The fifth stage, which in a uniform nomenclature ought to recall similar things, would, in this case, seem to imply a notable difference between the various kinds of delivery; for, in the same stage in vertex presentations, the body rotates without being expelled, whilst in breech cases the head rotates and is expelled at the same time. In order, therefore, to remove this apparent difference, it were better to divide the fifth stage of delivery by the pelvis into two stages, the fifth for the internal rotation of the head, and the sixth for its final expulsion. The throwing of these two stages into one, is essentially the same as confounding the third and fourth stages of delivery by the vertex.

In order to remove these imperfections and contradictions we have, therefore, described six stages in the mechanism of labor in each of the presentations; an innovation which has the advantage of showing clearly that this mechanism is uniform throughout. These views have been taught in our lectures, in the text of the *Atlas Complémentaire de tous les Traités d'Accouchements*, by Lenoir, and one of our students has made it the subject of his inaugural thesis. (Granier. *Thèses de Paris*, 1863, No. 98.)

For the clear understanding of this uniformity of the general laws of the mechanism of labor, we should observe in the first place that the fœtus,

doubled up as it is in the cavity of the uterus, with its limbs pressed closely against the chest, and the neck concealed between the base of the head and the upper part of the chest, forms really but two distinct parts, the head and the body. Now let us for a moment imagine these two parts to be separate and independent, and that they presented themselves one after the other; then we should have four stages for the expulsion of each. The head would be flexed, engage, rotate, and be delivered; nor would this succession of phenomena be in any respect altered whether the engagement of the head should precede or follow that of the body. The delivery of each of these two parts of the fœtus would then present similar phenomena to the observer; nor will there be the least occasion for surprise, when we consider that the section of each presentation gives an almost oval figure, the longer and shorter diameters of which are adapted in the same way to the curvature and form of the genital passages.

Setting hypotheses aside, if we examine a fœtus closely, we shall be at once struck with the fact that it represents two superposed masses, the head and the body so united by the neck that one cannot progress without the other; and that whilst the presenting part undergoes its four movements of compression, engagement, rotation, and disengagement, the remaining part has also become flexed and engaged, in other words, has performed its two first movements.

On the other hand, we observe, whilst examining a fœtus, that the long diameters of its two superposed parts (head and body) have opposite directions, from before backward for the head, and transverse for the body. These two diameters are also at right angles to each other, whence it happens that when one of the two parts has a direction adapted to its ready exit from the pelvis, the other will have an opposite direction. For example, when the head disengages from before backward at the vulva, the shoulders are situated transversely at the inferior strait; which renders it necessary that the head and body should perform successively the same mechanical movements of rotation and disengagement.

If we note, therefore, such mechanical phenomena only as are apparent and palpable, such, in fact, as the accoucheur is expected to detect at any moment, we shall have in the first place to observe successively the four motions performed by the part which engages first, and next the final movements of rotation and expulsion of the second part of the fœtus.

We have thus to describe six stages in the delivery:

1st Stage	Compression	of the first fœtal part.
2d Stage	Engagement	
3d Stage	Rotation	
4th Stage	Disengagement	of the second fœtal part.
5th Stage	Rotation	
6th Stage	Expulsion	

In the following table are recapitulated the six stages in the mechanism of labor for all the presentations.

TABLE of the six Stages of Labor in all the Presentations.

1st Stage. Adaptation of the presentation	Taking place in presentations	of the vertex	by flexion.
		of the face	by extension.
		of the breech	by folding.
		of the body	by folding.

2d Stage. Engagement.	Taking place in presentations	of the vertex.....by sliding. of the face.....by sliding. of the breech.....by sliding. of the body.....by sliding.
3d Stage. Rotation of the presentation.	Bringing under the arch of the pubis	the occiput.....for the vertex the chin.....for the face. a hip.....for the breech. a shoulder.....for the body.
4th Stage. Disengagement.	Taking place in presentations	of the vertex.....by extension. of the face.....by flexion. of the breech.....by progression. of the body.....by lateral flexion.
5th Stage. Rotation of the second fœtal part.	Bringing under the arch of the pubis	a shoulder.....in cases of vertex presentation a shoulder.....in cases of face presentation. the occiput.....in cases of breech presentation. the occiput.....in cases of body presentation (spontaneous evolution).
6th Stage. Final expulsion.	By disengagement	of the body.....in cases of vertex presentation. of the body.....in cases of face presentation. of the head.....in cases of breech presentation. of the head.....in cases of body presentation (spontaneous evolution).

By applying this general classification to each presentation separately, we obtain entire uniformity for the mechanism of every kind of labor.

VERTEX.

1st Stage.....Flexion of the head.
2d Stage.....Engagement of the head.
3d Stage.....Rotation of the head.
4th Stage.....Disengagement of the head.
5th Stage.....Internal rotation of the body.
6th Stage.....Expulsion of the body.

FACE.

1st Stage.....Extension of the head.
2d Stage.....Engagement of the head.
3d Stage.....Rotation of the head.
4th Stage.....Disengagement of the head.
5th Stage.....Internal rotation of the body.
6th Stage.....Expulsion of the body.

BREECH.

1st Stage.....Folding of the breech.
2d Stage.....Engagement of the breech.
3d Stage.....Rotation of the breech.
4th Stage.....Disengagement of the breech.
5th Stage.....Internal rotation of the head.
6th Stage.....Expulsion of the head.

BODY. (*Spontaneous evolution.*)

1st Stage.....Folding of the body.
2d Stage.....Engagement of the body.
3d Stage.....Rotation of the body.
4th Stage.....Disengagement of the body.
5th Stage.....Internal rotation of the head.
6th Stage.....Expulsion of the head.

CHAPTER IV.

TWIN LABORS.

ALTHOUGH the expulsion of the child often takes place in twin pregnancies with as much facility or sometimes even with greater rapidity than in ordinary labors, yet it must not be supposed that the whole duration of the labor is always shorter; for very often, on the contrary, the parturition will be found to drag along, and become tedious. Indeed, by reflecting on the circumstances which then complicate the process, it will not be a difficult matter to explain this unusual delay, since it is well known that an excessive distention of the womb greatly diminishes both the force and frequency of its contractions; and, as the labor often comes on before the end of the ninth month, the cervix uteri has not yet undergone those modifications which usually render its dilatation at term quite easy; besides which, the elevation of the presenting part, whose engagement is impeded by the presence of the second fœtus, also assists in retarding this dilatation. The stage of expulsion, which the small size of the twins would at first sight seem to facilitate, is often delayed by the feebleness of the contractions, and also by the decomposition and considerable loss of the force occasioned by the presence of an ovum, still remaining intact within the cavity of the womb; and such is the unfavorable influence of this latter circumstance, that it is only through the thickness of the second ovum that the contractions of the greater part of the uterine fibres can possibly reach the body of the child that first presented at the upper strait. But when the first child presents by the pelvic extremity, the escape of the head is particularly apt to be attended with difficulties; for, if the perineum be resistant, even in a slight degree, as in primiparæ, for example, the intervention of art will nearly always be indispensable, because the uterus, being wholly occupied by the other ovum, can have no further influence on the head of the first.

The following table, which gives the presentation of both children in three hundred and twenty-nine cases of twin pregnancy, will serve, as a matter of curiosity, to show the relative frequency of the positions.

IN 329 TWIN PREGNANCIES, THE TWO CHILDREN PRESENTED AS FOLLOWS:			
Both by the head. 134 times.	The 1st by the head; the 2d by the breech. 55 times.	Both by the breech. 12 times.	The 1st by the breech; the 2d by the head. 31 times.
The 1st by the breech; the 2d by one foot. 11 times.	Both by the feet. 8 times.	The 1st by the feet; the 2d by the head. 29 times.	The 1st by the breech; the 2d by the elbow. once.
The 1st by the head; the 2d by the shoulder. 7 times.	The 1st by the face; the 2d by the head. once.	The 1st by the feet; the 2d by one hand. once.	The 1st by the feet; the 2d by the breech. once.

Nearly always the twins present one after the other at the superior strait, and the expulsion of the first is promptly followed by the birth of the

second; and the same is true of the others when there are more than two But it occasionally happens that the labor does not progress so regularly and that the children may be born at a considerable interval from each other, and their expulsion rendered difficult by the attendant delays and dangers. It most generally happens that the womb, being fatigued by the efforts necessary for the expulsion of the first-born, retracts a little after this partial depletion, and remains in a state of rest for some minutes, in consequence of having lost a part of its contractile properties; still retaining, however, a greater volume than usual. By placing the hand on the anterior abdominal region, the accoucheur will be able to verify the abnormal size of the organ, and to detect, through this wall, the inequalities appertaining to the fœtus; besides, another amniotic pouch, or the presenting part of a second child, can readily be detected at the upper part of the uterine neck by the vaginal touch. In general, the repose of the womb is but momentary, and in about a quarter of an hour, sometimes at the end of five or ten minutes, though rarely later than twenty or thirty minutes, the patient feels the pains coming on again; at first feeble and slow, but soon becoming stronger and more energetic. Care should be taken to rupture the membranes, if this had not already occurred, and then to abandon the rest of the labor to the powers of nature. This second delivery is soon over, as a general rule, when the fœtus presents in a natural position, for the parts have been so enlarged by the passage of the first child, that they offer but little resistance to the escape of the second. But in some cases, the pains which have been suspended after the birth of one of the twins, do not reappear for some hours, and sometimes even not for several days.[1]

Now, what is to be done in cases of this kind?

"When the two children present well, and the expulsion of the first is effected naturally, and without great fatigue to the woman, I wait," says Merriman, "until the pains of the second childbirth come on; ordinarily, this happens shortly after the escape of the first-born. If efficacious pains do not occur in the course of a quarter or half an hour, I provoke the contraction by rubbing the abdominal tumor gently with the hand, and by titillating the os uteri with the finger; if these irritations, made simultaneously on the body and neck, are ineffectual, and several hours elapse without the womb contracting, I deem it advisable to excite the contractions, by rupturing the membranes, after having previously administered the ergot. This course is based on the two following reasons: where we have delayed too long a time, the pains have always appeared to me more severe than they would have been if the action of the uterus had been solicited sooner; and the expulsion of the second child has commonly seemed to me more easy through the parts recently dilated by the first delivery."

[1] Four women, registered in the Dublin Hospital, were delayed ten hours in the delivery of their second child. The reader will also find, in the *Medical and Physical Journal* (April, 1811), the details of a case in which the second child was not born until fourteen days after the first; and the author of that communication states, that another case had come to his knowledge, in which six weeks had elapsed between the birth of the twins. A woman was delivered on the 4th of March, 1814, of two children: she found herself so well on the second day that she rose to attend to her affairs, but, on the sixth, she was again delivered of two more. (*Gentleman's Magazine*, 1814.)

In all such cases, our rules of conduct should be based on the condition of the womb itself, rather than on the length of time that may have elapsed since the birth of the first child; because it must be evident that relaxation and inertia of this organ would forbid all attempts at extraction, and that we should never endeavor to deliver the second child before having excited the organic contractility of the uterus, by all the available means. If, by chance, these measures prove inadequate, it will be better to wait several hours, or, if necessary, even for several days, rather than expose her to the terrible consequences resulting from inertia.

[The presentation and position of each child in twin labors are detected by the same signs as when one child only is present, observing, however, that it is necessary to be careful in respect to the data supplied by palpation and percussion, for the presence of two children in the womb alters greatly the results afforded by the former; so that although these measures may sometimes prove helpful, they may also very easily lead into error.

That auscultation is equally unreliable and may be deceptive, will be understood from the fact that the idea of the position of the first child may be formed from the maximum intensity of the cardiac pulsation of the one which is born last.

What has been already said in regard to the touch, will suffice for twin cases also, although difficulty may arise from the simultaneous engagement of both children — for which case we refer to the subject of *dystocia*. (See *Dystocia*.)

The expulsion of each child is subject to the usual laws which govern the mechanism of labor as already described, so that we have only to add that as twins are often small and born prematurely, the inequalities in the mechanism of labor are more common, especially as regards the second child, which traverses the genital passages which have been enlarged by the first one. In short, we have only to regard a twin labor as two successive deliveries.]

CHAPTER V.

OF PREMATURE AND RETARDED LABORS.

ARTICLE I.

OF PREMATURE LABOR.

When a woman is delivered in the seventh or eighth month of her gestation, the labor is said to be premature. Now a great number of causes may determine the expulsion of the child, before the ordinary term of its intra-uterine life; such, for instance, as an excessive distention of the womb, whether this be occasioned by too great a quantity of the amniotic liquid, by hydrorrhœa, or by the presence of two or more infants in the uterine cavity; the accidental death of the fœtus; the artificial evacuation of the liquor amnii; any violent muscular effort; the abuse of strong purgatives; various acute diseases, more especially those of the skin; and certain conditions of the animal economy, as plethora, great debility, or an excessive irritability and sensibility. Finally, in a singular case already mentioned, premature labor occurred eight times consecutively, in consequence of extreme itching of the surface.

Delivery before term is said to be often preceded by a severe chill Burns supposes that this chill occurs immediately before or after the death of the fœtus. I have no recollection of having observed anything of the kind

In some cases, the uterus is fully developed prior to the ordinary term of gestation, and then the contraction commences and goes on as regularly as usual; but in most instances, the organ has not as yet undergone all the necessary modifications for the proper accomplishment of labor, and the latter, consequently, exhibits numerous irregularities in its course. The uterine neck and orifice are not yet properly effaced and softened. For example, it is not at all uncommon to find the neck sufficiently dilated, during the primary pains, to permit the introduction of the finger, and this notwithstanding the lips are still thick and of a considerable length. This length of neck must greatly retard the dilatation, for the latter cannot really commence until after the effacement is completed, which often proves a tedious process.

This first, or preparatory, stage is marked by pains that are very irregular both in their duration and intensity, accompanied by a feverish state; the patient experiences a very distressing sensation of weight about the belly, and she is usually restless and agitated. When the cervix is once effaced, the os uteri begins to dilate; but this dilatation is much slower than at term, because the neck has not yet attained the same degree of softening, and therefore offers more resistance to the contractions of the body.

But, although the first stage is somewhat longer, the second, or that wherein the expulsion occurs, is generally shorter than in labor at term, owing to the small size of the child; nevertheless, this advantage is often counterbalanced by the irregularity and the spasmodic nature of the contractions, which are then more apt to assume this form than under ordinary conditions. For, as the muscular organization of the uterus is not yet complete, we can understand why its contractile powers are less perfect; and also, on the other hand, how the morbid cause which has developed a premature action in it must necessarily influence the regularity of their contractions.

The vertex presentations are far from being so frequent here as in the natural labor at term, and those of the breech, according to M. P. Dubois, are proportionably more common as the labor is more premature. For instance, in ninety-six still-born children, delivered during the last two months of gestation at the hospital of La Maternité, seventy-two presented by the head, twenty-two by the pelvic extremity, and two by the shoulder; whilst in seventy-three living children, who had only reached the seventh month of intra-uterine life, sixty-one presented the head, ten only the breech, and two the shoulder. Hence, it is evident that the number of pelvic presentations in premature parturitions is comparatively greater where the children are born dead, and also that, when the fœtuses are living, the podalic extremity presents first much oftener than in ordinary labors.

Finally, according to Burns, women who are taken in labor before term are more exposed than others to hemorrhages during its progress, and the delivery of the after-birth is both more difficult and more liable to accident than usual.

"When a woman is threatened with premature labor," continues the author just named, "we ought, unless we are sure of the death of the child, to endeavor to check the process, which is done by keeping the patient cool and tranquil in the horizontal position, bleeding her in the arm if she be plethoric, or the pulse be throbbing; but above all, by administering opiate injections immediately (forty to sixty drops of Sydenham's laudanum, in two or three doses, in the course of a couple of hours)."

When the labor is once established, it is to be conducted much in the same way with parturition at the full time; nevertheless, says Burns, the following observations should be carefully attended to: 1. The patient must avoid much motion, lest a hemorrhage be excited; 2. Frequent examinations are hurtful by retarding the process, and tending to produce spasmodic contraction; and, if this takes place, a full dose of the tincture of opium should be given at once; 3. A rigid state of the os uteri requires venesection to a moderate extent; 4. The delivery of the child is to be retarded rather than accelerated in the last stage, in order that the uterus may have time to contract on the placenta; 5. This is to be further assisted by rubbing and gently pressing on the uterine region after the child is born; 6. The delivery of the after-birth requires more than ordinary care (see *Delivery of the After-birth*): thus, we are not to pull on the cord, for it is easily broken; besides, it is often necessary to introduce the hand in the uterus to aid the detachment of the placenta artificially, and to prevent its being retained by the irregular contractions; and lastly, great attention is to be paid to the patient herself for some days after the delivery, for it has justly been observed that she is, from the mere fact of having had a premature labor, more exposed than others to those inflammatory affections which so often complicate the parturient state. With regard to the premature labors brought on by the accoucheur we shall say nothing at present, as we shall have to treat of them more particularly under the head of *Operations.*

ARTICLE II.

OF RETARDED LABOR.

As an ordinary rule, the pregnancy terminates about the two hundred and seventieth day after conception. However, labor often occurs at an earlier period than this, and, on the other hand, it may not appear until some time in the course of the tenth month, or even at the termination of this period, although the latter is a much more unusual circumstance. In making this statement, we decide a question in advance that gave rise to some very sharp and animated discussions during the last century; and, still more recently, the tribunals of England have summoned to their bar the most celebrated physicians of Great Britain, and have listened to numerous and protracted pleadings for and against the legitimacy of retarded labors.

But this question no longer presents to the medical jurist the same difficulty that it did in the past century, for the French law has now declared every child to be legitimate that is born after the one hundred and eightieth

or before the three hundredth day of marriage; and, as if it were possible, in the eye of the law, for a pregnancy to continue more than ten months, it further adds that the legitimacy of a child born three hundred days after the dissolution of the marriage contract *may be* contested.

Although a legal decision has thus deprived the question of retarded labors of its greatest interest, yet we, as practitioners, may be permitted to recall briefly the principal reasons that militate in their favor.

At first, it was very natural to study the process in those animals which approach the nearest to man in this respect, in order to judge of the possibility of a retarded birth in the human species.

Among the numerous observations made on this subject, those submitted by M. Tessier, in 1819, to the Academy of Sciences at Paris, of which the following is a summary, are probably the most exact, namely: out of one hundred and seventy-one cows, fourteen calved from the two hundred and forty-first to the two hundred and sixty-sixth day: three on the two hundred and seventieth; fifty, from the two hundred and seventieth to the two hundred and eightieth; sixty-eight, from the two hundred and eightieth to the two hundred and ninetieth; and five, on the three hundred and eighth day, which gives a difference of sixty-seven days between the births, if we compare the shortest with the longest period. Of one hundred and two mares:

3	foaled on the	311th day.	
1	" "	314th "	
1	" "	325th "	
1	" "	326th "	
2	" "	330th "	
47	" from the	340th to the	350th day.
25	" "	350th "	360th "
21	" "	360th "	377th "
1	" on the	394th day.	
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Making a difference of eighty-three days between the two extremes. Nine months and ten days being the average term for cows, and eleven months and ten days for mares.

These well-ascertained variations in the terms of gestation in animals, certainly afforded a strong presumption of their existence in the human species also; for if cows and mares, whose gestations are not disturbed by the various causes that may lead to changes in a woman, may thus defer for some time the ordinary period, how much more would human females, who are subject to so many diseases, and upon whom the moral and social relations exert so powerful an influence,—how much more likely would they be to exhibit numerous varieties in the duration of their pregnancies?

But all this was a mere probability; and the question would still remain undetermined, if careful observations directly made, and well made on the human species, had not removed all doubts on that point; for several cases bearing on this subject now enrich our science, where a single well-established instance would suffice to produce conviction. Take, for example, the following case, reported by Desormeaux: A lady, the mother of three children, became affected with insanity, for which all the resources of thera-

peutics were tried in vain. As her physician thought that another pregnancy might possibly re-establish her intellectual faculties, the husband consented to note on a register the time of each sexual union, which only took place every three months, lest a previous conception (then uncertain) should be disturbed. Now, this lady, who was closely watched by her domestics, and was besides endowed with the most rigid principles of religion and morality, was not delivered before the expiration of nine months and a half.

Merriman furnishes a summary of one hundred and fifty gestations, in each of which he has noted the precise day of the last appearance of the menses. From this table it appears that—

5	women	were	delivered	in the 37th	week	— *i. e.* from	252 to 259	days.
16	"	"	"	38th	"	"	262 to 266	"
21	"	"	"	39th	"	"	267 to 273	"
46	"	"	"	40th	"	"	274 to 280	"
28	"	"	"	41st	"	"	281 to 287	"
18	"	"	"	42d	"	"	288 to 294	"
11	"	"	"	43d	"	"	295 to 301	"
5	"	"	"	44th	"	"	303 to 306	"
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The foregoing statement exhibits the great variety in the length of gestation. There is, in fact, a difference of fifty-six days between the two extremes; and, supposing that each woman became pregnant five days before the return of her courses, five of them, at least, would overrun the average term of nine months by ten or twelve days.

CHAPTER VI.

OF THE DELIVERY OF THE AFTER-BIRTH.

This comprises the natural or artificial expulsion of the fœtal appendages from the mother's womb, and is the complement of the labor. Like the latter, it is generally accomplished by the unaided powers of nature, though in certain cases, which are fortunately very rare (about one in two hundred), it is attended by difficulties or complicated by accidents that may require the intervention of art. We shall, therefore, have to treat of the natural and the artificial delivery of the after-birth, the former of which, only will be described in this place and the latter included in the article *Dystocio.*

Whilst the expulsion of the fœtus is being completed by the spontaneous exit of the breech and lower extremities, or immediately after the expulsion, the walls of the uterus retract in virtue of their inherent contractility of tissue, and its cavity diminishes; but the placenta, being a spongy and non-contractile mass, does not follow this action of the organ. Consequently, it becomes puckered up, and the cellular and vascular tissues, that connect it to the internal uterine surface, are rendered tense and then torn, as the

difference in the respective size of the two bodies becomes greater under the force of the repeated contractions. A rupture of all these bonds of union is soon effected, the placenta is completely detached and forced down upon the os uteri; the latter, being irritated by its presence, reacts on the body of the organ which is immediately thrown into contraction; the internal orifice, which was closed after the delivery of the child, again dilates, and the placenta, being driven from the uterine cavity, passes into the vagina, whence it is forced outwards by the contraction of the vaginal walls aided by the abdominal muscles.

Hence there are three distinct stages in the delivery of the after-birth; which we may divide, like Desormeaux, into the detachment of the placenta, its expulsion from the uterus, and its expulsion from the vagina.

The *detachment of the placenta* is not always accomplished in the same way; the process varying with the part of the uterus to which it is united. For instance, when attached to the fundus, the separation first begins near the centre of the mass, because this is the thickest part, and can least accommodate itself to the retraction of the uterine walls; whilst its thinner margins, being more easily wrinkled, are less liable to rupture the tissue connecting them with the womb; a lenticular cavity is thereby created, which is bounded externally by the still adherent borders of the placenta. A quantity of blood is gradually effused into this cavity, which contributes, with the uterine contractions, to effect the separation; thus, in this case, the detachment is effected from the centre towards the circumference. The placenta, being wholly detached, then descends to the orifice, its fœtal surface corresponding to the latter, and becoming the external face, whilst the uterine surface is the internal face, which, together with the inverted membranes, constitutes a pouch, wherein such a quantity of fluid or coagulated blood is occasionally collected, as to seriously impede its delivery.

When it is attached to the anterior, the posterior, or the lateral portion of the womb, the separation commences at one of the margins; or, if at the centre, it is soon propagated towards one border, generally the superior, though, in some instances, the inferior one. In the former case, the process advances in the way just described, and the placenta again presents, by its fœtal surface, at the cervix uteri; but, in the latter, being suspended on the uterine wall until the detachment is completed, it presents at the neck by its inferior margin. It is then generally folded upon itself, and engages in the orifice rolled up in a conical form.

When the placenta presents its fœtal surface at the os uteri, it plugs up the orifice by its bulk, and prevents the blood from escaping; wherefore, its delivery in such cases is usually followed by the expulsion of numerous large coagula. But where only one border engages, there is no obstacle to the issue of the blood, and hence the discharge of this fluid commences with the detachment of the after-birth, is increased at every pain, and persists throughout the whole process.

From the description just given, the reader would naturally suppose that the detachment of the placenta only begins after the child is born; this, however, is not always the case. In fact, the following phenomena are more usually observed to take place: as soon as the labor-pains are developed

and the dilatation of the os uteri has commenced, the separation of the ovum begins in the neighborhood of the uterine orifice, and then gradually progresses over all parts of its surface, although not in a perfect and complete manner. After the membranes are ruptured, and the waters are partially discharged, the uterine cavity diminishes; the ovum becomes wrinkled, and its detachment is carried to a still greater extent; even involving the after-birth, as proved by the fact that the fluid or coagulated blood is frequently expelled simultaneously with the fœtus, in cases of protracted labor; which blood must evidently come from that portion of the uterine surface in contact with the placenta. A separation of the greater part of the placental mass is particularly apt to occur in the breech presentations in consequence of the gradual contraction of the womb, as the lower parts of the fœtus are delivered.

The interval between the child's birth and the delivery of the secundines is very variable. Dr. Clarke, from a great number of observations, established its mean duration at twenty-five minutes; but if by this a perfectly spontaneous delivery is to be understood, one in which no traction is made on the cord, we believe he is in error, for this interval is generally much longer. At the instance of M. P. Dubois, we made some experiments, in 1836, with a view of determining this question; and those researches proved that, when the delivery was left entirely to nature, the final expulsion of the placenta did not usually occur under an hour or an hour and a half after the birth of the child. It is true, the detachment of the after-birth, and its removal from the uterine cavity, is effected, as Clarke states, in the course of fifteen, twenty, or twenty-five minutes; but, having passed into the vagina, it sometimes remains there for several hours without causing the least irritation by its presence, the least tenesmus, or bearing-down effort. This circumstance is easily explained by the fact that the sensibility of the vaginal walls is blunted, as it were, by the long pressure they were subjected to from the head and other parts of the child. Besides which, as Levret long since remarked, the after-birth will be the sooner expelled in proportion as the patient is stronger, and the contractions more energetic; as the quantity of water in the womb was smaller, and as the period between the rupture of the membranes and the delivery of the child was the longer.

Although its delivery may generally be left to the powers of nature without any serious inconvenience, yet it is equally true that it will be delayed a long time in a large number of cases. Now, such a delay would force the patient to remain on a bed, which is poorly adapted for repose after all the fatigues of labor; and besides, so long as the delivery is not completed, she still considers herself exposed to numerous dangers, and her fears may have an unfavorable influence over her condition. On this account, most of the accoucheurs of the present day believe it advisable to accelerate the extraction a little, for the purpose of relieving the woman from her anxiety, and of sparing her unnecessary pain; without, however, attempting to deliver the secundines *immediately* after the child's birth. But, before making any traction on the umbilical cord, it is necessary to ascertain the situation of the placenta, and especially the condition of the uterus. If the latter is small, hard, and contracted, and situated in the lowest part of the

abdomen, it is infinitely probable that the placenta is, in great part at least, expelled from the cavity of the womb into the vagina. This, however, may be easily ascertained, for the finger introduced into the vagina readily detects the mass, and even distinguishes the insertions of the cord. There is then, generally, nothing to prevent its being extracted at once, and simple tractions upon the external end of the cord are all that are required for this purpose.

When, on the contrary, the uterine tumor continues on a level with, or even above the umbilicus, and has a soft doughy feel, due to its imperfect contraction, the placenta is very probably still within the womb, and the first object should be to ascertain whether or not it is detached. Now we know that the separation is usually accomplished by the fresh contractions that reappear after the apathy which follows the expulsion of the child; and hence, there is every reason to suppose it is completed when these contractions have repeatedly occurred. A little blood usually escapes from the vulva during the process. Finally, if one or several fingers be passed up to the uterine orifice, the after-birth is found presenting there, and, if it should not be met with, the accoucheur may rest satisfied that the separation is not yet completed, and therefore he ought to wait. Should the detachment be delayed too long, frictions over the fundus uteri are resorted to, for the purpose of rousing the pains, or the same object is produced by titillating the cervix uteri with one or two fingers. Great care should be taken not to make frequent tractions upon the cord, for unpleasant consequences might result. Thus, if the placenta is completely adherent, the tractions are liable to detach a part, and give rise to hemorrhage, or they might tear away a portion of the after-birth and leave the remainder in the womb; again, the organ might be inverted or the cord ruptured thereby.

Certain writers recommend a ligature on the placental extremity of the cord after the child's birth, for the sole purpose of facilitating the detachment of the after-birth. The easy separation when this has been done, says M. Stoltz, is caused by the weight and turgescence of this organ, which, when expelled, is found to be engorged with blood; this practice is attended with no inconvenience, and is at least beneficial by preventing the patient's bed from being soiled with the blood that ordinarily escapes from the cord.

After its entire separation, the after-birth constitutes a foreign body in the uterine cavity, which the organ endeavors to dislodge by contracting. These contractions, which are recognizable by the hardness of the uterine globe, and which are usually perceptible to the patient, indicate the time for operating; the accoucheur then takes hold of the umbilical cord, after having enveloped it with a cloth so as to prevent it from slipping, and winds its end around one or two fingers; he next makes a moderate traction with a view of extracting it, but, as soon as any resistance is felt, he ought to slip up two or even three fingers of the other hand along the upper surface of the cord as far as the os uteri; the points of these fingers, which are intended to press the cord backwards, are brought together so as to receive the latter in the entering angle thereby formed, around which it plays like a pulley. To understand the advantage of this manœuvre, it is only necessary to bear in mind that the tractions made by one hand alone

would correspond to the axis of the vagina, which forms an angle with that of the uterus; whence it happens that the placenta, instead of being drawn towards the centre of the orifice it has to traverse, would abut against its anterior border, and the corresponding parts of the cervix, upon which all the tractive efforts are spent. The patient should be directed to bear down while the tractions are made. As the placenta clears the orifice, and gets into the excavation, the operator changes the line of action, and gradually carries the cord forward, so as to make it always correspond with the axis of the pelvic canal. Under the joint influence of the tractions and the patient's bearing-down efforts, the placenta soon reaches the vulva, where it is seized by the thumb and fingers and twisted round several times, so as to complete the detachment of the membranes and form them into a solid cord, for the double purpose of preventing their laceration and of securing their entire removal.[1]

It is impossible to state precisely the amount of force which may be used in these tractions upon the cord, and it must be left to the intelligence of the practitioner to discover what is proper to be done. When, however, the tractions have no effect, and the placenta seems to rise up and draw the cord after it, as soon as they have ceased, all efforts should be suspended for the time being.

"When the placenta is partially engaged in the orifice by a portion of its periphery, this plan," says M. Guillemot, "ought to be somewhat modified; for in this presentation, the root of the umbilical cord, instead of corresponding to the cervix, is higher up in the uterine cavity; and hence, if the operator resorts to traction, the centre of the placenta will have a tendency

[1] There certainly would be no very great danger in leaving a portion of the membranes in the uterine cavity; although, in addition to the accidents that may arise from the presence of a foreign body there, the following phenomenon might possibly occur. The membranes may inclose some coagula, and thus form a mass whose expulsion is often difficult. In the course of a few days, the uterus, being irritated by the presence of this inconvenient lodger, begins to contract, and the woman experiences some colicky pains, varying in intensity with the strength of the contractions; a little blood escapes from the vulva, and, after the pains have lasted for a longer or shorter period, the patient is finally delivered of the foreign body, or, according to her expression, of a *large piece of flesh*, the appearance of which causes great alarm.

Placental Expression. Crede's Method. Of late years, delivery of the placenta by compression of the uterus has been practised by many under the name of Crede's method. The plan described by this author is to seize the uterus with the hand, the fingers grasping the posterior and the thumb the anterior surface of the fundus. Owing to contraction, firm compression is made, thus forcing the placenta and membranes out of the womb. (See page 1073.)

Playfair recommends that the fundus should be grasped in the hollow of the left hand, the ulnar edge being well pressed down behind, and *when the uterus is felt to harden* strong and firm pressure should be made downwards and backwards in the axis of the brim. The uterine surface of the placenta, by this method, is generally the first expelled, the membranes remaining within the vagina.

The precaution is given to receive the placental mass in the palm of the right hand, to avoid any strain upon the membranes which might otherwise happen, and thus leave a portion within the uterus.

One objection to the above method is the chance of part of the membranes being torn off and left in utero.

to enter the orifice, and thus add its bulk to the disk already engaged there. Such a disposition sometimes constitutes an obstacle to the further delivery of this mass; but it is surmounted by making some moderate tractions, not on the cord itself, but rather upon the part previously engaged, by applying two fingers on its surfaces." We have had numerous opportunities of testing the practical utility of M. Guillemot's advice.

"This seems," says Merriman, "all that it is right to do, for a full hour after the child is born; but that time being elapsed, and there being no reason to expect that uterine contractions will spontaneously arise, the accoucheur is to consider whether it is prudent to wait longer, before he proceeds to extract the placenta, by introducing his hand into the uterus.

"If no bad symptoms are present, there can be no danger in allowing more time to elapse before we proceed to this operation; especially, if there be reason to think that the retention arises principally from the exhausted state of the patient; because it is possible that a little more delay will recruit her strength, and that afterwards sufficient power may be imparted to the uterus to expel the placenta.

"Yet, generally speaking, we can have but little expectation that the placenta will be expelled by the natural powers, after it has been retained much more than an hour; we may, therefore, consider ourselves justified in interfering to extract it, at the end of an hour or two after the child is born.

"It appears, then, to be a question of prudence or discretion, which every accoucheur must judge of in the individual case he is attending, whether to proceed to delivery at the end of the hour, or to wait another hour or two before he undertakes this operation. But, of course, this only applies to cases where there is no apparent danger." (*Synopsis*, page 153.)

"The time for interference of the accoucheur for the delivery of the placenta, should always be regulated by the condition of the uterus itself," says Dewees, "and that condition is whenever it is firmly contracted. Time, simply considered, can never form a safe rule for the delivery of the placenta; the *degree of contraction of the uterus* alone can point out the proper moment to operate, or teach us when it would be improper to attempt it. This rule, I believe, will never deceive, or at least I have uniformly acted upon this principle; and, so far, I think I am safe in saying, I have not had cause to believe it wrong." (*System of Midwifery*, page 447.)

As soon as the placenta is delivered, we must ascertain whether any portion of it, or of the membranes, has been left behind in the womb; but this is easily done by carefully examining the secundines. Should it happen that the membranes or after-birth are not extracted entire, it would be proper to pass the hand into the uterus, for the purpose of removing the remnants.

If a large quantity of the coagula that usually accompany the placenta remains in the womb, they may subsequently become a source of the after-pains yet to be described. Consequently, if there is reason to suspect the presence of large clots in the womb, the latter ought to be stimulated to contraction by repeated frictions over the hypogastrium. Some authors have even recommended the introduction of the hand into the uterine cavity, so as to rid it completely of all foreign bodies; the advice is good, but to be followed cautiously, because, on the one part, the uterus would

be unnecessarily irritated, and on the other, it would not prevent the subsequent formation of fresh coagula.

We stated above, that usually in the course of fifteen, twenty, or twenty-five minutes after the birth of the child, the uterus, by contracting, notifies the accoucheur, as it were, of the proper moment for his intervention. It should always be remembered, however, that moderate tractions are all-sufficient for the delivery of the after-birth; and, if much resistance is met with, it would be far better to wait, and not make any new attempts, until the contractions shall have partly or completely overcome the obstacle.

Where there is the least reason to suspect the existence of a second child, after the birth of the first, the physician ought to satisfy himself on that point, both by an external and an internal exploration, before attempting to remove the placenta; and should a twin pregnancy be recognized by the great size of the womb, and more particularly by the vaginal examination, a ligature is to be applied immediately on the placental extremity of the cord belonging to the first infant; and the secundines are only to be extracted after the expulsion of both children. If, however, the placenta were detached, and presented at the orifice, he should attempt to extract it, more especially when it seems to obstruct the passage of the second fœtus. Nevertheless, such tractions ought to be exceedingly reserved; because, in compound pregnancies, there are frequent adhesions between the two placentas; and, if this were the case, it is evident that any forcible traction might detach the after-birth of the second child long before its expulsion; and this premature separation would render the mother liable to severe hemorrhage, and the child to fatal asphyxia.

After the birth of both children, so far from pulling on the two cords simultaneously, and moderately twisting them into one, it is more prudent to bring down the placentas, one after the other, giving the priority to the one which offers the least resistance. The mass of these conjoined bodies is made to engage in this way by one extremity; and it is thus enabled to clear the uterine orifice more readily.

In most cases of compound pregnancy the womb is excessively distended, and this distention, as we are all aware, is one of the circumstances that is most likely to enfeeble the contractility of its tissue; therefore the removal of the after-birth, after the labor is over, should not be accelerated too much, and the womb must be allowed a longer time than usual for its retraction; while moderate frictions are to be made over the fundus of the organ for the purpose of stimulating its action.

As regards the removal of the secundines after a miscarriage, we have nothing to add further than what will be stated in the article on *Abortion*.

CHAPTER VII.

OF THE NECESSARY ATTENTIONS TO THE WOMAN AND CHILD DURING LABOR.

ARTICLE I.

OF THE ATTENTIONS TO THE WOMAN DURING LABOR.

When the accoucheur is summoned to a woman in labor, he should always provide himself with lancets, a female catheter, and the forceps; and, if in the country, he should have besides some ergot, either the wine or the fluid extract, and one or two drachms of Sydenham's laudanum. His arrival ought always to be announced before entering the patient's chamber, for the emotion caused by a sudden entrance often proves sufficient to suspend the pains for a considerable time. Then, after having made the usual inquiries as to the time at which the pains began, their frequency, their duration and intensity, he might, if he supposes from this account the labor to be somewhat advanced, proceed at once to the vaginal exploration; in the contrary case, he may wait a few minutes, as well to satisfy himself of the value of the communications made by the attendants, as to give the woman time to prepare for the examination. When he finally judges this is necessary, he is to proceed with all possible decency, and always during the interval between the pains. The object of this is to endeavor to ascertain: 1, whether the woman is pregnant; 2, if she is in labor; 3, if she is at full term; 4, whether the membranes are ruptured; 5, whether the labor is far advanced; 6, what is the condition of the cervix, vagina, and perineum, and their degree of suppleness or resistance; 7, what is the conformation of the pelvis; 8, lastly, what part of the child presents.

At first sight, it may seem a ridiculous precaution to attempt to verify the existence of the pregnancy in a woman who declares she is actually suffering from the pains of childbirth; but, to say the least, this is not altogether useless, since it has unfortunately happened that some over-confident accoucheurs have been imposed upon by women who were themselves deceived as to the nature of the pains they felt; and we might quote many instances where, after having waited for the delivery to take place for several days, they have ultimately been constrained to acknowledge their mistake. Besides, this error is easily avoided by bearing in mind the diagnostic signs pointed out in the article on Pregnancy.

After observing the progress of the pains for some instants, he should next endeavor to ascertain their cause and nature, in order to favor those which have a bearing on the labor, and to combat any that are foreign thereto. Women are not unfrequently tormented by pains during the latter stages of gestation, which are dependent on some sympathetic disorder of the intestines, or abdominal organs, and which even a physician might mistake for the commencement of labor; these have been denominated the *false pains*, by way of distinguishing them from those produced by the contraction of the womb. The true and the false pains may be recognized by

the following characters: the latter are ordinarily seated in the region occupied by the diseased organ, while those occasioned by the commencement of the travail usually begin about the umbilicus and loins, and die away at the perineum, the anus, or the sexual parts; the false are almost continuous, and their intensity is nearly uniform; the others, on the contrary, are intermittent. If the irregularity in the return and progression of the pains be such as to leave any doubt as to their character, he should interrogate the neighboring organs, and by a little attention he will succeed in determining their seat and nature. There are, however, certain pains which have their seat in the uterus itself, affect a certain degree of regularity, and simulate a true labor, which are dependent on a plethoric condition of the organ, that may be calmed by rest, a restricted diet, and blood-letting. Further, the epoch at which they occur, and the absence of the other phenomena of labor, will serve to lessen the difficulties in determining the diagnosis; nevertheless, it is the touch alone that can dispel all doubts; for the hardness that comes on in the uterine globe, the rigidity in the circumference of the os uteri, the tension and protrusion of the membranes during the pain itself, together with the retreat and relaxation of all these parts in proportion as it diminishes, characterize the pains of childbirth in an infallible manner.

"By examining," says Wigand, "the course of the true contractions, it will be found that they commence at the cervix, and pass to the fibres of the fundus, which are then thrown into action; and hence all contractions that begin in this latter part of the womb are anomalous, and result either from some disorder having occurred in the uterine forces, or else they are produced by an inflammation, or a disturbance in the functions of a neighboring organ." When the true pain is manifested, the head, which reposed during the interval on the cervix, sometimes mounts up even beyond the reach of the finger, but the membranes engage more or less in the orifice. In the course of a few seconds, the contraction extends all over the uterus, and more particularly to the fibres of the fundus; and the head, which was at first elevated, is forcibly pressed down on the neck, thus assuming the office of a wedge for hastening its dilatation; and, as a general rule, it is only when the fundus contracts in this manner, that the woman complains of pain. We may, therefore, consider the true pain as constituted of a series of phenomena, which succeed each other in the following order: first, the periphery of the cervix becomes tense; then, the presenting part ascends, and the membranes bulge out; next, the remainder of the uterus, the fundus especially, becomes hard, during which the patient complains of a sharp pain; and, lastly, the part that presented endeavors anew to engage. It is unnecessary to add, that the rapidity with which these phenomena succeed each other necessarily varies according to the individual, to the irregularities to which the process is subject, and according to the stage of the labor. Other things being equal, the contractions will effect the dilatation so much the sooner, in proportion as the cervix shall correspond more directly to the fundus of the organ, and the uterine axis shall be the more parallel to that of the pelvis.

After having learned the true character of the pains, the accoucheur next

endeavors to ascertain whether the woman is really at term, so as not to encourage a premature labor, which might often be prevented if he knew its cause. He ought, therefore, to recall the various signs, by means of which we have attempted to characterize the different periods of pregnancy. Thus, should he find that the cervix is not yet entirely effaced, that it still retains a certain degree of length, that it is hard and resistant even during the interval of the contractions; that the latter are much less regular in their course, duration, and return, than in parturition at full term; and the belly not yet sunk down; he may justly conclude that the patient has not yet reached the end of the ninth month; also, that such a premature labor is owing either to some acute moral emotion, or some antecedent external violence. In all cases, he ought to attempt the arrest of this premature or false labor, by rest, both of body and mind, by venesection, if the woman's general condition will admit of it, and, more especially, by the administration of laudanum in full doses, taking care to empty the bladder when necessary, and to keep the bowels free by mild laxatives.

The use of means to stop the premature labor ought not to be given up, even though the cervix be entirely effaced, the orifice somewhat dilated, and a certain amount of water discharged; inasmuch as the escaped fluid might proceed from a hydrorrhœa and not from within the amnios, whilst premature pains can sometimes be calmed and the pregnancy enabled to proceed to full term.

Very conclusive observations on this point were published in 1857 by Dr. Charrier: he cited cases in which the dilatation equalled a quarter of a dollar in size, and in which the pains were suspended notwithstanding the membranes were engaged in and projecting from the orifice. The cervix afterwards closed in such a way as to reproduce its external orifice, and to present the conical shape which it has in the eighth month of gestation. This phenomenon, styled by M. Charrier, *retrocession of labor*, though doubtless rare, need only be possible in order to encourage the practitioner to suspend the labor whenever he is sure the membranes are intact, the child alive, and the woman not at term.

However, there is one phenomenon, sometimes manifested in the latter weeks of gestation, which may place the most skilful practitioner at fault. I allude to what has been designated as the *false labor*, in which certain women, after having nearly reached their full term, experience the true contractions; the pains are regular, the membranes bulge out, and the os uteri dilates; at times, these pains last from four to six hours, but then they disappear all at once, and everything goes on as usual. In others, the false labor is kept up at first during several hours, and then it passes off, returning in this manner every day, particularly towards the evening, and lasting one or two weeks. (See *Uterine Rheumatism.*)

When the accoucheur is very sure that the woman is really in labor, his attention must be directed to the frequency and the intensity of the pains, and to the dilatation, the hardness, and thinness of the cervix, in order to judge of its probable duration. During the same exploration, he should ascertain the conformation of the pelvis, particularly if the woman happens to be in her first confinement, and if any apparent deformities exist; he

should also learn the situation of the orifice, the obliquity of the body and neck of the womb, and the child's presenting part. (See *Mechanism of Labor.*) If this latter is so high up as to render the diagnosis of the presentation difficult, its examination should be deferred until a more advanced period of the labor; but the bag of waters is never to be ruptured, in any case, for the mere purpose of rendering this examination more easy, before the entire dilatation of the neck; for such an untimely rupture of the membranes would be attended by very great inconveniences, if the position were at all defective; for, all the waters escaping, the fœtus might suffer from the pressure exercised directly upon it by the uterine walls; the umbilical cord would be compressed; and the womb, irritated by the prolonged contact of the fœtal inequalities, might be affected with spasmodic contractions; and, finally, the intervention of art becoming necessary, long after the evacuation of the waters, the necessary manipulations would be attended with much greater difficulties.

But it is not always so easy a matter as one might imagine to ascertain whether the membranes are ruptured or are still intact; for instance, where the vaginal examination is resorted to between the pains, in a vertex presentation, they are often applied so directly to the scalp that it is impossible to distinguish them. A pain should then be waited for, because, as soon as the uterus contracts, it drives the waters towards the lower parts, and the finger is observed to be raised up by a small quantity of this fluid that insinuates itself between the head and the amniotic sac, the integrity of which latter is thereby easily verified; but where the head is more deeply engaged, this afflux of liquid is very inconsiderable, and the tension of the membranes can scarcely be distinguished. Consequently, attention should be given to the state of the tumor both during and after the contraction. Where the waters have escaped, and the finger comes directly upon the child's cranium, it will detect the hairy scalp puckering up while the pain lasts, and becoming smooth and even as soon as it shall have ceased; though the contrary will take place when the membranes are intact, for they are never more smooth or more tense than during the contraction itself.

It is difficult at times to reach the cervix uteri in the commencement of the labor, because it is then carried so far backwards that the plane of its orifice actually looks towards the anterior face of the sacrum. I have often seen young practitioners who were unable to get at it at all, and others, who, not finding the os uteri, and distinctly feeling the child's head through the anterior inferior part of the womb, which is then rendered very thin by the distention it has undergone, have imagined that the dilatation was already completed, whereas it had hardly commenced; the disastrous consequences to which such an error might lead, can be readily imagined. In fact, it is very often necessary to pass the finger around the convex tumor which fills the excavation, in order to get the index far enough upwards and backwards, where the uterine orifice is to be found.

All these questions being determined, the accoucheur's attention should be directed early in the progress of the confinement to having the woman moved into the most suitable place. The chamber intended for her lying-in should be spacious, airy, well lighted, and retired; the air she respires ought

to be pure and of a moderate temperature, and all strong odors, whether good or bad, should be excluded. A temperature too elevated will predispose her to nervous agitation, and to hemorrhagic accidents; and, on the other hand, the impression of cold is a very frequent cause of acute inflammation, or of chronic engorgements, such as those that often come on after delivery, which have for so long a time been attributed to lacteal metastasis. But few persons are to be admitted in the chamber, and all those, especially, whose presence is at all unpleasant to her, ought to be rigidly excluded. This latter point demands the greatest care on the part of the physician, for it is he alone who has authority thus to dismiss such as he may think useless or injurious, and he must judge, from the reception given to each, of the pleasure or otherwise the patient experiences from their presence. Some women are almost ashamed of being delivered in the presence of the husband; with others, on the contrary, it is one of the greatest consolations to have him near them, and the accoucheur must endeavor to discover all the little shades of delicacy and feeling, to sound, by discreet and artful questions, a wish that the woman herself at times fears to express, and, after having once learned it, he should religiously comply with it. As a general rule, the mother and sister, or two intimate friends of the patient, besides the nurse, are the only ones that are to be allowed to stay in the room. With regard to dress, her garments should be full, sufficiently so, as neither to incommode her movements nor her respiration.

If some time has elapsed since she has had a passage from the bowels, a simple injection must be given; and where this does not prove sufficient to procure a stool, a second is to be immediately administered with the addition of one or two ounces of the *miel mercuriale*.[1] The evacuation of the matters contained in the rectum is the more necessary, as its distention might subsequently retard the escape of the head, and likewise prevent that of the intestinal gases, whose accumulation might bring on colic and gripings; besides, this precaution has the advantage of sparing the woman the shame and disgust which an involuntary expulsion of the fæces during the last moments of labor would necessarily cause, as also of preventing the accoucheur's hand from being soiled, while it supports the perineum.

The accumulation of urine in the bladder ought likewise to be prevented, by persuading the patient to urinate in the very commencement of her parturition; for, where she has not observed this precaution, or the physician arrives too late to insist upon it, the emission of water becomes more and more difficult, and sometimes quite impossible, owing to the compression which the head, engaged at the superior strait, makes on the neck of the bladder. In such cases, he should endeavor to push the head up somewhat by two fingers, so that she can urinate; and if this does not succeed, the catheter must be resorted to. We have elsewhere stated that it was advisable, under such circumstances, to use a male catheter, the curvature of which is greater; though, even by taking this precaution, a considerable resistance is occasionally experienced to its introduction. This condition

[1] This preparation is only used as an injection; it is prepared by taking equal parts of clarified honey and the juice of the *mercurialis annua*, a plant belonging to the tribe of the Euphorbiaceæ, and reducing them to the consistency of a syrup.—*Translator*

requires the most careful manipulation; the woman must lie flat on her back, and then, with one hand the womb is pressed backwards from the strait, or what is preferable, while the head, which by its presence in the lesser pelvis compresses the urethra, is raised by two fingers in the vagina, the other introduces the instrument into the urethra.

The accumulation of urine is attended with such grave consequences as to warrant a persevering effort to introduce the catheter. The least of all the accidents which may result therefrom, is a relaxation, or even the total cessation of the pains; for the distressing sensation caused by a distention of this organ, which is increased when the abdominal muscles contract, induces the woman to suspend the contractions as much as possible; besides which, the pain itself is sometimes so acute as to paralyze, as it were, the action of these muscles; and again, as they are separated from the uterine walls by the mass of urine shut up in the bladder, their action is transmitted to the womb in but a very feeble manner. The paralysis of the bladder, so often met with after labor, is a common consequence of prolonged retention of the urine; and finally, the walls of this reservoir are occasionally ruptured just at the moment when the woman gives way to the most violent bearing-down. Doubtless this last accident is rare, but still it is not without example, since Ramsbotham, Sen., has observed two cases of the kind. (*Obs. Pract.*, cases 89, 90.)[1] The tumor thus formed by the over-distended organ may easily be recognized, more particularly after the rupture of the membranes, by the soft, fluctuating tumefaction detected immediately above the pubis, extending at times nearly as high as the umbilicus, at the side of, and behind which, the hard resistant mass constituted by the uterus can be distinguished, whose consistence varies according to whether the examination is made during or after pain.

He should also attend early to having everything prepared that may be wanted somewhat later; thus, the thread intended for the ligature of the cord is to be laid out, and the band and linen for covering the child's navel are to be cut; for the mother, he ought to procure some cold iced water, vinegars, and smelling-salts, agents that will probably be unnecessary, but which, notwithstanding, he ought always to have at hand; and, lastly, he must direct the preparation of the bed upon which the woman is to be delivered. This bed (called the lying-in bed, the bed of misery, or the little bed) is arranged in the following manner: one with a sacking-bottom is procured, of a moderate height, and about two feet to two and a half in width, and one end of it is placed against the wall, being careful to keep it clear on both sides, so that one can pass freely all around it. A first mattress is placed on the bottom, and upon this a second, which covers its upper part, and is folded double towards its superior third, in such a way as to leave the first one uncovered about the foot. An oil-cloth, then a sheet,

[1] The symptoms of this accident are very similar to those of a rupture of the womb, excepting that the child remains *in situ*. There is, besides, a sudden and sharp pain in the vesical region, and the patient complains of the sensation caused by the effusion of the liquid into the abdominal cavity, syncope, &c. The signs peculiar to the vesical rupture are the collapse and disappearance of the tumor previously formed by the bladder (which could be felt above the pubis), and an obscure fluctuation in the belly

some pillows, and a coverlet, complete the furniture of the bed. A solid bar is placed transversely across the foot of the bed, so as to give the woman's feet a solid point of resistance in the last moments of her labor. In France, the patient is so placed that the upper part of her back rests on the inclined plane formed by the second mattress, and her breech at the margin of the same mattress; the inferior extremities are slightly flexed, and the feet press against the transverse bar placed at the foot of the bed. In England, women are delivered on the edge of their beds; they lie on the left side, having their legs and thighs flexed, and their knees separated by pillows. In Germany, the lying-in chair of the ancients is used; the patient is placed on an inclined plane, which can be modified at will, by lowering or raising the back, by means of a rack; the woman then draws on the arms of the chair, and presses her feet against the rounds with which it is supplied, and, as she gives way to the throes of labor, the sexual parts are uncovered, and correspond to the opening made in the edge of the seat. But, on the whole, the bed, furnished as we have described, appears preferable, the more so, because it is always at hand; and, as suggested by Desormeaux, it is particularly suitable where the woman must remain recumbent during the whole progress of labor, as is necessary whenever she is affected with hernia, or is threatened with hemorrhage, prolapsus, or a displacement of the womb. In case of necessity, its place might be supplied by a table and a few chairs placed against the wall. It would be much better, say Desormeaux and M. P. Dubois, where the family are in easy circumstances, to make use of an ordinary bed, taking care, however, to supply it with a rather hard mattress, and a hard cushion near the buttocks, to prevent the pelvic region from sinking down into the substance of the mattress, and the borders of the hole thereby produced, from forming an obstacle to the extension of the coccyx, or the escape of the child's head. On this bed, the woman is more at ease; she can lie on her side, or take the most convenient attitudes, and even sleep during the intervals of the pains; and then, after the delivery, she may remain there some time before being transported to another.

Ought the accoucheur to remain constantly with the patient? This is a question whose solution varies according to the character of the female herself, and the greater or less intimacy existing between her and her physician, for there are some timid women who desire to have him always close at hand, and others again, who are impatient and annoyed by his continual presence. But in all cases, he should bear in mind that, during parturition, the patient very often wishes to urinate or to empty her bowels, and he ought, therefore, to go from time to time into an adjoining chamber, in order to give her the desired opportunity. Again, during the labor, a wife is frequently cheered up by the caresses and consolations bestowed by her husband; the physician will understand that his presence at such times must act as a restraint, and he should discreetly withdraw, or, at least, not observe what is going on. Further, he may absent himself more frequently during the period of the dilatation; for instance, after having made the examination, and ascertained that the child's presentation and position are both favorable, he might, if the cervix was just beginning to dilate, attend to his other

occupations, and return again in the course of a couple of hours; but if the diagnosis of the position had been impossible, or if the latter had proved to be an unfavorable one, he must not quit her under any pretext, in order to be always ready to ward off any accidents which might subsequently demand his intervention. When the stage of expulsion commences, the accoucheur places himself at the right of the bed, on a chair of a suitable height. The part he has to perform consists, in a natural labor, in ascertaining its progress, from time to time, by the touch, in directing properly the bearing down efforts of the patient, and in sustaining the perineum with his hand while the child's head is passing through the vulva.

During the first stage, the woman may lie down, sit down, or walk about, at her pleasure; indeed, this frequent change of position renders the slowness and fatigues of childbirth more supportable; but, at the end of this stage, when the dilatation is completed, and the amniotic sac projects strongly, and is on the point of yielding, she must then resume her bed; and this precaution is particularly indispensable in those who have already borne several children; because, in them, the expulsion of the fœtus sometimes follows so promptly after the rupture of the membranes, that the patient has not always the time to regain her bed, and is liable to be delivered standing. But when, after the rupture, the progress of the labor is slow, and the head is more or less engaged in the excavation, or has already descended as low as the perineum, but does not advance, and the pains seem to become more and more feeble and distant, it is advisable to recommend her to get up and walk about, having her supported by assistants, if her own strength does not permit her to walk alone, for it is found by experience that bodily motion seems to give more activity to the uterine contractions. In the contrary case, she must not leave the bed without some special indication. Where the patient is tormented by pains in the loins, we may relieve them by stretching a folded napkin under the small of the back, and directing two persons, placed at the opposite sides of the bed, to pull on the extremities of the towel during the pain. Attempts should be also made to assuage the cramps, so often experienced in the thighs and calves of the legs, by voluntary contraction of the antagonist muscles of the suffering ones, which will be far more effectual than frictions over the suffering parts.

Some nervous women are troubled with tremblings and chills, in the very commencement of their labor, which are at times sufficiently marked to cause much disquietude. Dewees observed that they often coincide with an unusual rapidity in the dilatation of the cervix, and he says: "A lady, who every moment expected her labor to commence, was awakened suddenly in the night by a violent chill. The nurse became alarmed, and I was immediately sent for. When I arrived, I found her still trembling very severely, but she had not experienced any symptoms of labor; she assured me that nothing was the matter with her except what I was witnessing, namely, an agitation of the whole body, which she could not, by any effort, control. In about five minutes, she cried out she believed her labor was coming on; and this really was the case, and so rapidly as not to give me time to place her in a proper situation for delivery; she was delivered in less than five minutes from the time she first called my attention to her. These shiver-

ings are sometimes renewed during or immediately after the labor, but in no case do they merit a serious attention."

Patients are often frightened at the time the bag of waters is torn, and it is therefore a good plan to advise them of it beforehand; and the precaution should also be taken of placing a sponge or some old linen near the genital parts, so as to receive the liquids as they escape. Immediately after the discharge of the waters, it is advisable for the practitioner to assure himself anew of the presentation and position, lest he might have been deceived in the first examination.

The rupture of the membranes generally takes place spontaneously, but this is not always the case, and the accoucheur must sometimes interfere. It is very certain that when the uterine orifice is entirely dilated, when the membranes are forced into the vagina by a large quantity of fluid, and the head is movable, but still the contractions do not produce a spontaneous rupture of the membranes,—it is evident, we repeat, that they, by their resistance, prolong the labor. Although this obstacle is never insurmountable, by the efforts of nature alone, yet the delay in the delivery and the dragging on the membranes may be attended with some inconveniences, and it is therefore better to lacerate them. This is done by taking advantage of a strong contraction, and, while they are greatly distended, forcibly pressing the index finger against the centre of the tumor.

When this rough pressure is not sufficient, we scratch the membranes with the finger-nail; and by gradually weakening the three tunics, succeed in rupturing them. Sometimes, however, they still resist, and then some instrument, such as a blunt probe, or, still better, the end of a quill cut down, is directed up to them along the finger. M. Dubois made for the same purpose a very convenient instrument, consisting merely of a piece of whalebone sharpened at one end. Where the waters are *flat*, that is, when but little liquid intervenes between the membranes and the head, some care is requisite, in using the little instrument, to direct it obliquely, so as not to wound the fœtus with its point. Rupturing the membranes is, therefore, a trifling operation; still, excepting in some rather rare cases to be spoken of hereafter, it ought not to be performed until after the orifice is thoroughly dilated. Whatever the presenting part may be, there is always an advantage in retaining a large amount of fluid in the uterus.

Some peculiar circumstances may, however, demand the artificial rupture before the dilatation is completely effected.

In a case reported by Baudelocque, the child was so movable, that it successively presented every part of the surface of its body at the os uteri. In a woman whose belly was distended by a great quantity of water, M. Martin, of Lyons, had recognized the feet and one hand through the membranes. "I then felt disposed," says he, "to terminate the labor, when, at the request of her husband, I called a friend in consultation; but on touching her again, before his arrival, I detected the head where I had previously found the feet and hand, when I immediately punctured the membranes, whereby the head was fixed at the superior strait and the delivery rendered natural." (*Comptes Rendus*, p. 155.) Should a case of this nature be met with, the rule we have just given might be laid aside, and the membranes

be ruptured, however inconsiderable the dilatation. It is scarcely necessary to add that an artificial rupture is only to be resorted to when the fœtus shall be detected presenting by its cephalic extremity; for then the discharge of a certain quantity of the amniotic liquid, and the retraction of the uterus, will irrevocably fix this part at the upper strait.

Again, according to the majority of writers, the membranes may be lacerated before the entire dilatation of the cervix, where there is reason to suppose that the waters, from their too great abundance, distend beyond measure, and thus weaken the contraction of the uterine walls; but, even here, Gardien recommends the greatest circumspection, and advises the previous employment of all the measures calculated to stimulate the contraction of the womb.

Finally, we shall learn hereafter that the puncture of the ovum at an early period of labor, is one of the most effectual means of arresting certain dangerous hemorrhages which may supervene during its progress.

The finger ought to be introduced into the vagina several times in the course of the last stage of labor, both during the pains and in the interval between them, to ascertain the progress of the head in the excavation. Nevertheless, this exploration is to be resorted to as rarely as possible, and only when the interest of the mother seems to demand it.

Most women, supposing that they can materially hasten the termination of the labor by making the most of their pains, contract their muscles, bear down violently, and make extraordinary efforts at the beginning; but these uselessly exhaust their strength; for, so long as the neck is ineffaced, and the bag of waters unbroken, all bearing-down effort is fruitless. But in the second stage, where the head descends into the excavation and rests on the perineum, she should be encouraged to aid the uterine forces by a voluntary contraction of the muscles of the trunk and limbs; though, as soon as the pain has passed off, all the auxiliary efforts should be at once suspended. Again, in the latter moments of the travail, just when the head is about to clear the vulva, the pains are so sharp that the woman naturally gives way to incredible exertions, which may possibly occasion serious accidents; hence all the powers of persuasion should then be employed to induce her to moderate her strainings.

During the last moments of childbirth, the pressure of the head on the lower part of the rectum creates an urgent desire of emptying the bowels; and many women, yielding to a misunderstood modesty, then wish to rise and retire to the closet; but it would be exceedingly imprudent to comply with their demand, and they must not leave the bed under any pretext whatever. In the first place, this desire is often illusory, more especially where the precaution has been taken to empty the intestine at the commencement of labor; and then it may happen, as I once witnessed, that the patient, surprised by a violent pain, is delivered on the close stool, without the physician being able in any way to render her the necessary attentions.

It is in these last moments that the accoucheur must give all his attention to supporting the perineum, which is done by pressing the whole perineal surface equally, and with a moderate degree of force, by the palmar face of the hand. The latter is applied in such a way as to make the radial

border of the index finger cover the anterior margin of the perineum, the ends of the fingers corresponding to the left side, and the thenar eminence of the palm to the right side of this partition, while the thumb is held to the right of the labia externa. The pressure should be somewhat greater near the anus, so as to give the fœtal head a forward direction, and facilitate its movement of extension. (See article, page 680.)

Finally, whatever may be the child's position, we should, contrary to the opinion of certain authors, abstain from introducing the fingers into the lower part of the vagina, or making pressure on the perineum and coccyx; in a word, from performing what they call their *little labor*. There are, however, a few measures which may be useful; for instance, when the genital parts exhibit great rigidity, heat, and dryness, the emollient injections, or frictions with mild ointments, such as cerate, or cucumber ointment, emollient fumigations, or bathing in lukewarm water, may be very advantageous. This last remedy, especially, is of marked utility where the abdomen is tender and painful, and the cervix uteri is rigid and resistant.

Within a few years, Professor Simpson has introduced into obstetric practice the use of those anæsthetic agents, which are daily productive of such wonderful results in surgery. The Edinburgh accoucheur does not, however, reserve ether or chloroform for difficult cases, but advises their use in the most natural labors. The importance of the subject demands of us a detailed examination; and a long article will be found appended, in which, after having stated the known results, we shall give frankly our own opinions.

Regimen of Women in Labor.—Those women whose labors are unusually short, need not, as a general rule, take any nourishment whatever; but when the travail drags along, it is necessary to sustain their strength by articles of easy digestion; thus, as many are in the habit of taking coffee with milk every morning, this may be allowed them without danger; and then, during the day, a few cupfuls of some broth may be given, though always in small quantities at a time. Where the stomach is disordered and vomiting takes place, as very frequently happens, even these liquid aliments will have to be restricted. This plan, however, is not applicable in all cases, since some must be allowed what we should refuse to others; for example, there is no necessity for subjecting robust country-women to the same severity of regimen as the delicate ladies of large cities. The choice of drinks is also a matter of some importance, and we may recommend some pure or sugared water, or a weak infusion of lime, or orange-leaves, of mallows, violets, &c. Lemonade, or wine diluted with water, will be very agreeable to most women at first; but, in general, they soon produce a sour stomach and eructations; all hot cordials and fermented liquors should be positively prohibited. In the country districts, there is often much difficulty in overcoming the vulgar prejudices on this subject; but the physician must insist upon it, for he ought never to lose sight of the distress and agitation that follow the administration of spirituous beverages, and which expose the patient to inflammations and active hemorrhages. Should it happen that her feeble condition requires any restoratives, then some good broth, or a little old wine, or a few spoonfuls of sherry-wine, are the only and the best means that can be employed.

ARTICLE II.

OF THE ATTENTIONS TO THE CHILD DURING LABOR.

Having determined the presentation and position, the accoucheur should next ascertain whether the child is living or dead, as it is highly important to determine this point, in order to diminish his own responsibility, by advising the family of the fact.

Before the membranes are ruptured, the diagnosis may be easily made out by ascertaining through auscultation the existence or absence of the pulsations of the fœtal heart, as also the continuance or complete cessation of the active movements, in regard to which the woman can always give sufficiently accurate information. After the rupture of the membranes, the active movements are feeble, and sometimes entirely absent; in which case, however, the pulsations are still detected by auscultation.

The touch also reveals certain signs which may shed still further light upon the question. Thus, when the child is alive and the head presenting, it often becomes affected with a sanguineous swelling, the size of which depends upon the length of time which has elapsed since the discharge of the waters. This tumor does not form when the child has ceased to live; and if its death dates back for several days, the resisting tumor formed by the sero-sanguineous infiltration will be replaced by a soft, flaccid, and wrinkled condition of the hairy scalp. Besides this, the bones of the cranium will be more movable, and the overriding of their edges greater than usual; a sort of crepitation is also produced by their rubbing against each other. A more embarrassing case is that in which the child dies some time after the rupture of the membranes, but not before the sanguineous tumor has had time to be developed. Even here the uncertainty will be of short duration, for, provided the labor should continue beyond three or four hours, the tumor will lose its consistency, and its softness and flaccidity render a mistake a matter of difficulty.

Finally, when the pelvis is rather contracted, the wrinkling of the scalp may simulate a swelling, whose diagnostic importance it is well to appreciate. In this case, says Merriman, the best means of judging of the life or death of the child by the tumor of the scalp is as follows: when living, it is observed that, at the moment when the head is strongly urged down by the contraction of the womb, the bones overlap each other, and, as a consequence, the scalp becomes folded, and thus constitutes a temporary tumor; but immediately after the pain is over, the head regains its primitive form, by the expansion of the cranial bones, and the folds and tumefaction previously exhibited by the skin disappear, or, at least, considerably diminish. On the contrary, however, if it be dead, the expansibility of the bones is destroyed, and the head does not reassume its primitive form and volume after the contraction has passed off; wherefore the tumor formed by the doubling of the hairy scalp still persists, in a great measure. Now, in this condition of affairs, the swelling is sometimes greatly augmented by the liquids forced in by the pressure from above, and whenever, in such cases, a perforation of the cranium has to be resorted to, practitioners well know there is half an inch at least of soft parts to be traversed before reaching the bone. (Merriman's Synopsis.)

If the face should present, the softness of the lips, and the flaccidity and immobility of the tongue, should lead us to suspect that the child is dead; since, when living, the firmness of all its parts, and the motion of the tongue, are often felt with ease.

In breech presentations, the introduction of the finger into the anus will detect a resistance and contractile power on the part of the sphincter if the child be living, which will be absent if the child be dead.

Lastly, in shoulder and arm presentations, the swelling of the member, and its violet hue, will afford an indication in favor of its life.

Should the cord hang in the vagina, its softness, withered condition, and the absence of pulsation in the umbilical arteries, would justify a belief that the child was dead.

A thick and fetid condition of the amniotic fluid, and a discharge of meconium, have been regarded as indicating the death of the child. The altered condition of the waters is of no great importance, since it has sometimes been found to coincide with perfect integrity of the fœtal life, but the discharge of meconium is of greater significance.

It is not at all uncommon to find the meconium escaping in greater or less quantity during parturition; and, as previously stated, this peculiarity most frequently occurs in the positions of the pelvic extremity, and is then of little consequence; but this does not hold good in any other presentation; for then its discharge is always an unfavorable sign, one calculated to arouse the anxious solicitude of the medical attendant, as it usually indicates a state of suffering on the part of the child, which is almost always due to a compression of the cord. It must be apparent, on the least reflection upon the part performed by the placenta during the intra-uterine life, that an interruption of the fœto-placental circulation produces asphyxia, which latter determines a cerebral congestion, and sometimes even an apoplectic effusion, whence a paralysis of the sphincter ani results. Now, if to this palsy of the sphincters, we add the instinctive acts of respiration[1] made by the fœtus, which are the more violent as they are the more ineffectual, we can understand without difficulty how an escape of the meconium may result from a compression of the cord.

As regards the prognosis, it is important to observe the precise moment at which this discharge takes place, as it is always serious when it does not occur till some time after the rupture of the membranes; though the waters, when they escape, are often colored yellow, and the presence of the meconium then is not necessarily an alarming symptom. In some cases, it may indeed indicate an actual compression of the cord; but it may also result from a compression that had existed some time before birth, which may have compromised the child's life for a few moments, and then have suddenly disappeared in consequence of some brisk movement of the infant.

It is not difficult to conceive that the cord might undergo a momentary compression during the last months of gestation, as also that it might be displaced by a sudden motion of the child, and the fœto-placental circulation be re-established in consequence. Now, this compression may have

[1] Mayer has observed respiratory movements in embryos, even within the ovum, as soon as he compressed the cord.

lasted so long as to threaten asphyxia, and consequently to produce a discharge of meconium.

Endeavors have been made to determine by the physical characters of the meconium, whether its discharge was occasioned by a presentation of the breech, or by the sufferings of the fœtus. It has been said that, in the latter case, the meconium is very fetid, thinner, and more diluted, than when the breech is above the uterine orifice. Such signs, however, are very inconclusive.

On the whole, therefore, a discharge of meconium in breech presentations is of little consequence; but, in the other presentations, and where occurring some time after the rupture of the membranes, it is always an unfavorable sign; though, to judge of its value at the time of the rupture itself, recourse must be had to auscultation.

Of all these signs, the best undoubtedly is that supplied by auscultation of the heart, whose pulsations are always perceptible if the child be living. It is quite possible for the pulsations of the cord to escape detection even though the fœtus be living, inasmuch as they sometimes stop during the pain and begin again when it is over. Therefore, certainty of diagnosis would require that the pulsations should have ceased for a considerable time, ten or fifteen minutes at the least.

In vertex presentations, as soon as the head is expelled its disengagement is effected.

Immediately after its expulsion, the disengagement of the head is completed, either by carrying it more and more towards the pubis, or by insinuating the index upon one side of the lower jaw; this being accomplished, we must next ascertain whether the cord does not make one or more turns around the neck, and if so, gentle tractions must be made on its placental extremity, to avoid its being dragged upon, and to prevent strangulation of the fœtus, &c.; and when a sufficient extent of it cannot be brought out, to render the prevention of such accidents certain, we have to cut it, and terminate the labor as promptly as possible, by hooking one or the other shoulder with the forefinger.[1] After the head is born, the womb, exhausted by its last efforts, remains passive for some instants, and it frequently happens that the child begins to respire and cry, even before the delivery of the chest. We may, therefore, wait patiently until the contraction is renewed, simply supporting the head, lest the mouth and nose be choked up by the cloths or blood found between the woman's thighs; but if the atony is prolonged, and more especially if the face of the new-born infant is observed to be red and tumefied, as sometimes happens after painful labors, the remainder of the travail ought not to be left entirely to nature, but new pains should be at once solicited by frictions over the abdominal walls, and the patient be encouraged to bear down. The disengagement can almost always be accomplished by moderate tractions upon the head grasped

[1] These folds may occasionally be drawn so tightly as to strangle and kill the infant, as occurred in the following case: "Upon approaching a woman who had just been delivered, I found the child dead, and still lying near the genital parts; the cord made three turns around its neck, and they were so firmly tightened that a deep ecchymosis was seen on this part." (Guillemot.)

by both hands; and if these measures prove insufficient, the index finger, curved like a hook, is to be placed in one of the armpits, and the disengagement of the anterior shoulder thereby first effected.

After the shoulders are disengaged, the spontaneous expulsion of the breech and lower extremities may also be delayed in consequence of inactivity of the womb. Here again, it is especially proper to endeavor to excite the contractions by frictions upon the abdomen; but should the life of the fœtus appear to be in danger, the extraction should be effected immediately.

The artificial extraction of the shoulders or of the lower part of the trunk, we see, ought not to be resorted to until expectation might become dangerous to the fœtus. When the expulsion is left entirely to nature, the womb contracts in proportion as it is emptied, and there is less cause to fear the consecutive inertia which is sometimes produced by too rapid an extraction.

In those rare cases, where the occiput remains posteriorly until the end of labor, most accoucheurs have recommended that an attempt should be made to bring it round to the front, but we doubt whether this will often prove successful, although we have never seen it tried, nor ever attempted it ourselves; for we believe that where the process of rotation does not take place spontaneously, all efforts to produce it artificially would be useless, not to say injurious. Nevertheless, most authors advise, when the head has descended into the excavation, immediately after the discharge of the waters, to make it deviate either towards the right or the left in the *interval between the contractions* (Velpeau), by slipping two or three fingers either along the sacrum, to press the occiput forward, or else upon the side of the forehead, behind the pubis, to carry it backward. If we should ever entertain the thought of attempting this manœuvre, we would much prefer acting during the contraction, for then we should only aid, without absolutely supplanting nature; we would prefer, whilst acting upon the occiput, as indicated by Velpeau, applying, at the same time, two fingers on the temples, and acting thereupon in such a way as to turn the forehead posteriorly. But, we repeat, this appears unnecessary in the great majority of cases, because it only hastens the process of rotation, which would have subsequently taken place without it; and even hurtful in others, for the efforts used to bring it about might exert a pernicious influence both on the mother and her child.

In fact, in ordinary cases, where the rotation is produced by the natural powers, the trunk follows the movements of the head; but where the latter has been turned by the fingers, the body remains immovable, and hence the process of forced rotation may dislocate the atloido-axoid articulation and kill the child.

The older accoucheurs thought that a spontaneous delivery, in face presentations, was altogether impossible, and consequently they advised an endeavor to be made, in the very outset of labor, to convert them into vertex positions; but we of the present day understand better the value of such opinions. However, the rotation by which the chin is brought under the symphysis pubis, whatever might have been its primitive relation to the superior strait (see *Mechanism of Delivery by the Face*), is difficult, painful,

and sometimes, in the mento-posterior positions, does not take place at all. It will be seen, further on, that the non-accomplishment of this movement forms one of the most serious complications met with in practice, and that craniotomy often becomes necessary in consequence. When the face is engaged at the inferior strait, and the chin is found under the pubic arch, the movement of flexion begins, and then, as has been shown, the pressure to which the vessels of the neck are subjected, during the fourth stage, may retard the circulation enough to determine death by cerebral congestion. Hence, we learn what great precaution is necessary in supporting the perineum, since it must be evident that too great a pressure made upon this part would necessarily augment the compression of the child's neck.

The delivery by the pelvic extremity ought to be abandoned entirely to nature, unless there are some unfortunate complications. We have already insisted upon this point in the note at page 354; but do not hesitate to repeat again the advice, not to resort to any traction in a natural labor by the breech, because, as there stated, a stretching out of the arms, and sometimes even an extension of the head, result from such imprudent tractions, whilst these complications are scarcely ever met with where the expulsion is left to the uterine contractions entirely. Now, there is no difficulty in comprehending these different results, for when the womb is the sole agent of the delivery of the child, the latter is forcibly urged on by the circular fibres at the superior part of the organ, and at the same time is strongly pressed on its sides by the longitudinal fibres. The upper extremities are therefore maintained against the lateral and anterior parts of the chest, the head is kept flexed on the thorax, and all these parts descend together; but, on the contrary, if any tractions are made, they only act on the trunk, which then descends alone, while the arms, being arrested by the margins of the cervix uteri, or by the periphery of the straits, do not participate in the descent, and are ultimately found placed against the sides of the head; hence, the accoucheur's exclusive duty consists in receiving and supporting the lower parts of the child as they become disengaged; taking care, as soon as the breech has cleared the vulva, to ascertain the condition of the cord. For that purpose, the forefinger is slipped up as far as the navel, when, if the cord is found to be tightened at its umbilical insertion, he joins the thumb to the index so as to produce some traction on its placental extremity only, with the view of preventing both its being dragged upon, and its possible laceration. The cord sometimes gets between the infant's thighs; and, in such cases also, the loop thereby formed must be enlarged by pulling on the placental extremity, and then by disengaging it from the posterior limb, bring it into contact with the perineum, that is, with soft parts whose compression will be less severe, and consequently less dangerous to the circulation than what it would suffer from the symphysis pubis; but if it is too short to be brought to the exterior, it must be cut, and have a ligature applied on its umbilical extremity, and the labor be terminated as rapidly as possible.

But, whatever may have been the cause, the death of the fœtus always results from the slowness with which the shoulders and head are expelled for it is only during this last part of the travail that the cord is compressed,

or that a separation of the placenta takes place; hence, although we have condemned all traction in general, it must be otherwise under such circumstances. But how is it possible to determine the period beyond which it would be imprudent to wait? We answer, that as soon as asphyxia comes on, the suffering condition of the child may easily be detected by examining the portion of the cord which has been delivered; and if the pulsations still maintain their intensity, their frequency and habitual regularity, the rest of the process may be abandoned without danger to the powers of nature; but, on the contrary, if they are found to relax, or even to become more rapid, though at the same time more feeble, thread-like, and especially if intermittent or irregular, every effort must be used to remove the fœtus from the danger which threatens it.

The signs furnished by the irregularity of the pulsations of the umbilical arteries, and to which great importance has been attributed by some authors, only become sensible after the asphyxia has lasted for so long a time that it is not always possible to overcome it; therefore we regard as much more available the phenomena next to be mentioned.

When the head alone remains behind in the pelvic excavation, the child is very often observed to dilate its chest actively, and make a violent inspiratory effort, which may be referred to a rapid convulsive contraction of the diaphragm and abdominal muscles, repeated at irregular intervals; now such acts never take place while the fœto-placental circulation remains intact, since the pulmonary respiration is unnecessary so long as the placental one is going on, and therefore these struggles constantly announce a state of suffering, or of imminent asphyxia, from which the infant must speedily be relieved. Where the head alone is undelivered, the patient must be encouraged to bear down strongly, so as to hasten the termination of her labor, and avoid a prolonged compression of the cord; and the accoucheur might facilitate the flexion of the head by gently carrying the trunk up in front of the symphysis, or when the flexion appears difficult, he may, by insinuating two fingers under the symphysis, press slightly on the occiput; for a comparatively light force exercised on the posterior part of the head is often sufficient to reverse the great occipito-mental diameter, and terminate the delivery. Should the head resist these efforts, other measures become necessary; but they belong to instrumental delivery, and we shall treat of them in the article on *Version*.

Finally, should it be impossible to extract the head immediately, we may endeavor to introduce the fore and middle fingers into the mouth of the child, and then separate them slightly, so as to leave an open space through which air might find its way to the mouth. The same object would be effected with still greater certainty, by introducing a large catheter into the mouth.

CHAPTER VIII.

OF THE ATTENTIONS TO THE WOMAN AND CHILD IMMEDIATELY AFTER DELIVERY.

ARTICLE I.

OF THE ATTENTIONS TO THE WOMAN IMMEDIATELY AFTER DELIVERY.

As soon as the child has been expelled, the accoucheur should place his hand upon the mother's abdomen in order to ascertain whether there is another child, as also to learn whether the uterus contracts well, inasmuch as inertia of the organ should lead to the anticipation of hemorrhage. It would also be right to determine whether there be too free a discharge of blood from the external parts.

The expulsion of the placenta and its annexes, whether spontaneous or assisted by the accoucheur, generally follows very shortly after the exit of the fœtus. In order to avoid separating the study of this natural delivery of the after-birth from that of the difficulties and dangers which may attend it, we shall treat of them separately. (See *Delivery of the After-birth.*)

After the delivery, the accoucheur should ascertain, both by the external examination and the vaginal touch, whether the placenta has drawn down or inverted the fundus of the womb, for the purpose of rectifying it at once if such an accident has occurred. If everything proves to be in its natural condition, frictions with the hand are to be made over the hypogastric region from time to time, in order to excite the retraction of the uterus, and thus favor its disengorgement, and the expulsion of the coagula which may be still contained there. The patient is allowed to remain for some minutes on the bed where she was delivered, so as to give her a little repose, as well as time to the uterus and vagina to clear themselves of the blood, which flows at first in abundance, and would soil the linen in which she is about to be enveloped. Besides, a few minutes are ordinarily devoted to paying those necessary attentions to the infant, hereafter pointed out. In fact, she might remain upon the same bed a still longer period, when the delivery has either been preceded or followed by syncope, hemorrhage, or any other accident, or even where there is reason to fear something of this nature, taking care, however, to substitute dry things for those that have been soiled. She ought to lie perfectly flat, the thighs stretched out alongside of each other, lightly covered, and be left in silence, and the most absolute rest of both body and mind. In about half an hour, the patient will again require special attention; the genital organs, and upper part of the thighs, are to be first washed carefully and gently with lukewarm water, pure or mixed with a little wine; then they are to be wiped with warm and well-dried towels, and all the garments worn during parturition that have been soiled by the perspiration, discharges, and fecal matters, are removed. and replaced by others, previously well dried and warmed; their shape is unimportant, the only point requisite is to have them large enough not to incommode the woman in any way, and to admit of being changed easily

and promptly. The greatest celerity is to be used in this toilet, lest she should be long exposed to the air; the arms and breast particularly ought to be well clothed, so that the patient may, during the day at least, keep them out of bed without danger of taking cold.

All these preparations being completed, she is next to be transferred to the bed intended for her reception during the lying-in. Many females, finding themselves well enough, want to walk across to the permanent bed; but against such an imprudence the physician must interpose the whole weight of his authority. The one to which she is to be transported must be previously warmed, and provided with a sufficient amount of covering that can easily be changed; though the coverlets should not be thicker or more numerous than those used before pregnancy.

There is a custom much in vogue of surrounding the belly with a moderately tightened bandage; and the women, for the most part, attach the highest importance to this measure as a preservative against the wrinkles and folds that are found after labor on the skin of the abdomen, as also to prevent the latter from remaining too voluminous. Their desires may be yielded to the more willingly, as such a bandage, when moderately drawn, supplies the pressure no longer afforded by the abdominal walls, and thereby prevents the afflux and stasis of the fluids, the engorgement of the uterine walls, and the dilatation of the cavity of this viscus; and it has the further advantage of obviating the tendency to syncope, and of diminishing the after-pains. But, in order to obtain all these benefits, it should be large enough to compress the whole sub-umbilical region equally. Care should be taken to prevent its becoming doubled up, whereby a circular cord is formed, which, from opposing the ready return of the fluids, would then prove a cause of hemorrhage.

The body bandage may be substituted with advantage by a folded cloth applied flat upon the abdomen which it compresses gently by its weight, which is sufficient for the purpose.

Some women, influenced by a feeling of coquetry, also desire to compress their mammæ by means of a bandage, with a view of preventing their enlargement, and their consequent softness and flaccidity, and some even go so far as to apply topical astringents for the purpose of obviating an overabundant secretion of milk; but such measures should be proscribed in the most absolute manner, since they might prove very dangerous. These organs only require a sufficient amount of covering to protect them from the contact of the external air, and to maintain a proper degree of heat.

ARTICLE II.

OF THE ATTENTIONS TO THE CHILD IMMEDIATELY AFTER ITS BIRTH.

The management of the new-born infant necessarily varies according to whether it is strong, vigorous, and healthy; or whether, on the other hand, it is born in a state of debility or disease.

§ 1. Of the Child in a Healthy State.

When the child escapes from its mother's womb living, and in a healthy state, the circulation existing between it and the placenta is observed to

continue for some time, where the delivery is abandoned entirely to the powers of nature; the after-birth is soon detached and expelled, and then it as well as the cord loses its vitality, the circulation becomes weaker and weaker, and the pulsations in the arteries gradually cease, commencing at their placental extremity; and some authors have advised this event to be waited for before cutting the cord; but as this spontaneous delivery most generally requires a long time, it is customary to make the section immediately after its birth, and then the following attentions to the new being become necessary, namely: where the infant is entirely clear of the mother's parts, the cord is disengaged if it had been twisted around its neck or body, and the child is placed on the side, having its face turned away from the vulva, so that it may breathe freely without running the risk of being suffocated by the liquids that escape from the vagina. The umbilical cord is next cut at about five or six fingers' breadth from the abdomen, generally using the scissors for this operation, though it may be done with any cutting instrument whatever. As soon as the section is effected, the cut extremity is slightly pinched between the thumb and forefinger, while the remaining three fingers grasp the breech, and the other hand is placed under the shoulders and neck of the child, which is thus lifted out of the bed, and placed on the nurse's knees prepared for its reception. It may then be examined more at leisure, to ascertain that no loop of intestine exists at the base of the cord, and to permit the latter to bleed if judged advisable, before applying the ligature. A ribbon, eight or ten inches long, may be used for this latter purpose, or a cord consisting of a skein of coarse thread; but, before applying it, the gut is to be reduced if there is an umbilical hernia, and then it ought to be tied at about two, three, or four inches from the surface of the abdomen; the only precaution requisite is to avoid placing it around the skin, which is prolonged more or less upon the cord; for pain, inflammation, and ulceration would thereby result, the subsequent cure of which might be attended with some difficulty. As a general rule, it is best to leave sufficient space between the ligature and the fold of the skin, to allow of the application of a second, should the first prove insufficient. The ligature must be drawn tight enough to obliterate the arteries completely and permanently, without cutting their coats. If the cord happens to be thick and infiltrated, the ligature will strangle its vessels but very imperfectly; and when it afterwards becomes diminished by the escape or evaporation of the fluid parts, the vessels being no longer compressed, will obviously permit a free discharge of blood from the cut end. Besides, the putrefying of the lymph will soon produce a very fetid smell, and irritate the skin wherever it comes in contact; and it is therefore, to prevent such accidents, that authors very properly recommend the expression of this viscid fluid by pressing and slipping the cord between the fingers, and even by pricking its enveloping membrane, taking care, however, to avoid wounding its vessels; and lastly, if the cord were unusually large, it might, for greater security, be bent backward after the first knot was tied, and be included in a second one. Where there is reason to suspect a twin pregnancy, it is necessary after cutting the cord of the first-born to apply a ligature around its placental extremity also. Though the application of the second ligature is, in most cases, a use-

less precaution, yet the fact that in some very exceptional cases in which a communication exists between the vascular ramifications of the two placentas, it might prevent a hemorrhage which would quickly prove fatal to the second child, is sufficient reason for never dispensing with it.

Numerous discussions have sprung up as to whether the ligature of the umbilical cord was absolutely indispensable, and, if so, whether it should be applied prior to the section, or whether the cord might be cut before it is tied. Now, although it is highly probable that the circulation in the umbilical vessels would be arrested spontaneously, after the regular establishment of the respiration; as, also, that the ligature is almost or entirely useless in the great majority of cases, yet, if it is certain that a hemorrhage has taken place in some few, even though they be exceptional instances, from the cord having been imperfectly tied, or else not ligated at all; this, of itself, is a sufficient reason for not neglecting so simple a precaution; and as to the second question, the course just pointed out is, in our opinion, decidedly preferable.

The surface of the child's body is next to be cleansed of the ceruminous substance that covers it, and from the blood and other matters which become attached at the moment of delivery; but as this can scarcely be removed by a simple rubbing with dry towels, it should first be diluted with a little oil, or fresh butter, and then be gently wiped off; the yolk of an egg would produce the same effect, and besides, would render this matter more miscible with water. To get rid of the blood and other impurities, water mingled with wine, or else a simple bath, into which the child is plunged, is most generally employed; the temperature of the bath should be about twenty-five degrees (77° Fahr.).

The infant being well washed, sponged, and wiped, is next to be dressed; but, before doing so, the physician himself should first envelop the cord in a compress intended for that purpose; which compress is merely a piece of fine linen, of a square shape, and having an opening at its centre large enough to allow the cord to pass through it easily, and then, after having ripped one of its sides from the free margin down to this hole, the root of the cord is lodged at the bottom of the resulting fissure; then the uncut part of this little compress remains below, and the two halves of the divided portion are turned over and crossed in front of the cord, the whole being placed at the upper and left side of the abdomen. A second soft and square compress covers the first, and a band three or four fingers' breadth wide, and long enough to go twice round the body, supports the whole of the little apparatus in this position.

Before enveloping the cord, the dressing of the child had already commenced, its head, arms, and chest being then covered. The rest of its clothing should be warm, soft, and moderately tight. In France, it consists of a camisole, or little woollen jacket, furnished with a soft chemisette that is fastened behind by pins, then one of linen, and another of wool or cotton. The English envelop their children in a long, loose robe, or something like a flannel sack.

Before dressing the child, the physician should ascertain whether it is affected with any malformation; and during the three or four days following

its birth, he ought carefully to watch over the excretion of urine and of meconium (for the expulsion of the latter is sometimes delayed for that length of time), and to facilitate it by plunging it into a tepid bath, when he is certain the infant is well formed. The prolonged retention of the meconium is also an indication for the employment of some mild laxative, such as whey, the syrup of violets, the oil of sweet almonds, or manna; the compound syrup of succory is also very generally used, or the compound syrup of rhubarb, either alone or mixed with sweet almond-oil, in the quantity of two drachms or half an ounce in the course of the day. Some persons administer these gentle remedies to all children without distinction, more especially to those that are wet-nursed, for the purpose of supplying, they say, the place of the colostrum, or first maternal milk, whose slightly purgative action clears out the intestinal canal; but the warm water and sugar ordinarily given to the child as nourishment on the first day, is usually quite sufficient to facilitate the expulsion of the meconium, and the viscid fluids that sometimes obstruct the fauces and stomach.

§ 2. Of the Child in a Feeble or Diseased State.

The ordinary attentions to the child, when born in a healthy condition, have just been described; but it not unfrequently happens that the infant, at the moment of its birth, is in a state of great debility, or even of apparent death, which would soon be followed by a real one, if adequate measures were not resorted to at once to prevent it. This apparent death shows itself under two widely different aspects, which have been described by most authors as the apoplexy and the asphyxia of new-born children. Many English and German accoucheurs have for a long time rejected these denominations, as characterizing but imperfectly the pathological conditions to which they were applied; and M. P. Dubois, in a more recent article, after having remarked that the most constant anatomical character of apoplexy in the adult is wanting in what has been called the apoplexy of the child, and that wide differences also exist between the symptoms of asphyxia in grown persons, and those of the asphyxiated state of the new-born infant, likewise concludes that the same name has been improperly applied to such dissimilar conditions; and consequently he, like M. Nægèle, designates that state of the child in which no sign of life is observed, and none of those of death is recognized, under the title of apparent death.

Both terms of this definition are evidently contradictory, since death is characterized by an entire absence of the signs of life. For our own part, we regard apparent death as a state in which, notwithstanding the abolition of the actions of animal life, some at least of the functions of organic life continue, and, of necessity, the pulsations of the heart.

Now, in carefully examining the symptoms of the child's apparent death, it is found that it is sometimes characterized by a vivid redness of the face and upper part of the body, by a prominence and injection of the eyeball, and a swelling of the countenance, the skin of which is dotted here and there with bluish spots; while at others, we are struck with the discoloration

in the skin, and the flabbiness of the flesh. In the former case, the head is swollen and very warm, the lips are tumefied and of a deep-blue color; the eyes start from the head, and the tongue adheres to the roof of the mouth; the head is often elongated, hard, and the features slightly swollen; the pulsations of the heart, though sometimes quite strong and distinct, are at others obscure and feeble; occasionally the umbilical cord is distended with blood.

In the second, the child exhibits a mortal pallor; its limbs are pendent and flabby; the skin is discolored, and is often soiled by the meconium; the lips are pale; the lower jaw hangs down, and the umbilical cord and heart either do not palpitate at all, or but very feebly. An infant, in this condition, often moves at the moment of birth and cries, but soon falls back again in a state of apparent death.

These diversities in the physical characters of children born in a state of apparent death, may be occasioned, doubtless, by various causes, though they are also often due, simply, to a greater or less advanced condition of the same pathological state; hence it is wrong to regard them as the characteristic signs of quite dissimilar lesions. Therefore, although I am convinced that they sometimes furnish indications for very different kinds of treatment, and that under this point of view it is important to observe them carefully, I cannot regard them as affording a basis for nosological distinctions which it is impossible to justify. As the expression *apparent death* presupposes nothing in regard to the nature and cause of that state, it deserves on that very account to be retained.

That what we are about to state respecting the apparent death of newborn children may be the better understood, we shall give, first, a brief exposition of the mechanism by which respiration is established immediately after birth.

All physiologists admit, that the medulla oblongata is the centre and regulator of the respiratory movements of the adult. From it also is sent forth the motor impulse which gives rise to the first act of inspiration.

Marshall Hall has endeavored to prove, experimentally, that the first inspiration is the result of a reflex action,[1] produced by the excitement of the nerves of the surface of the body, especially of the trifacial, by the contact of the external air, and that the respiration, when once established, is sustained through the influence of the reflex action due to the irritation of the pneumogastric nerves by the contact of the air introduced into the lungs.

[1] An impression made upon our organs may give rise to movements of different characters, by pursuing different routes to the cerebro-spinal axis. Thus, sometimes, when transmitted directly to the encephalon by the sensitive nerves of the cranium, or indirectly through the nerves of the spinal marrow, it is transformed into a sensation in that part of the encephalon in which the *sensorium commune* is situated, and consequently reaches the consciousness of the animal, who is then capable of reacting by voluntary movements. Sometimes, also, it is transmitted by the nerves of sensation either to the encephalon or to the spinal marrow, which impression, without necessarily being transformed into a sensation, may produce an excitement which is immediately reflected upon the motor nerves, and gives rise to the so-called *reflex* movements, in the production of which the will has no part whatever.

The power which thus gives rise to movements without the participation of the will, has been regarded as a special endowment of the cerebro-spinal axis, and has been designated as the *reflex power, faculty, or property.*

The same physiologist also holds that the respiratory movements may take place under the influence of other causes; such, for example, as the impression produced upon the medulla oblongata by a great loss of blood, as also the excitement which it undergoes from the contact of venous blood. Into the latter category enter all the respiratory movements of incomplete asphyxia.

In normal cases, the fœtus, having in no wise suffered during the labor, retains its cutaneous sensibility intact, and the irritation produced by the contact of the air with the cutaneous nerves is transmitted to the medulla oblongata, which, acting in its turn upon the respiratory nerves, produces the movements of respiration.

But should it happen that the fœtus from the moment of birth has been deprived for a certain time of those means of respiration which it finds in the placenta, or that, the latter being separated immediately after the child is expelled, any obstacle should arise to the introduction of air into the bronchia, there would be, in both cases, a commencement of asphyxia. The contact of the non-oxygenated blood would irritate the medulla oblongata, and this irritation being transmitted to the inspiratory nerves, may also give rise to respiratory movements of the muscles of the face, breast, and abdomen, and produce, in short, the first inspiration.[1] The central motor impulse would soon be substituted by the reflex action of the ramifications of the pneumogastric nerves, which are irritated by the air introduced into the lungs, and the respiration would continue under its influence.

When the fœtus is threatened with asphyxia in the latter stages of pregnancy or during labor, in consequence of compression of the cord or separation of the placenta, its death is preceded by convulsive movements and efforts to breathe; then the mothers tell us, that the child, after having moved actively, suddenly became quiet; and Beclard saw a fœtus inclosed in the unruptured membranes make inspiratory movements, and breathe water instead of air. It is for this reason, also, that in certain positions of the face the child has been enabled to respire, although still inclosed in its mother's womb; and the uterine vagitus, which always supposes a previous inspiration, can be explained in no other manner. In all these cases, in fact, the non-oxygenated blood acts as an irritant to the medulla oblongata, which transmits the irritation in its turn to the nerves of inspiration. Nothing can be claimed here for reflex action.

We must be careful, however, not to confound these two excitors of the inspiratory act. The first is the natural excitant, whilst the other is always pathological, and only intended to replace the normal stimulus. Now, every

[1] Marshall Hall removed the brain of a kitten, cut the pneumogastric nerves, and opened the trachea. He found the respiration to become slower, though it continued with regularity. When he stopped the opening in the trachea, the scene changed immediately; the animal opened its mouth widely, made violent inspiratory efforts, and was affected with some movements of a convulsive character. When the trachea was reopened, the respiration became as regular as before, and when closed again, the symptoms of asphyxia reappeared; in both these cases, the central organ, or the medulla oblongata, was evidently the source of the respiratory impulse: since the destruction of the brain and the section of the pneumogastric nerves rendered all reflex action impossible.

pathological act is but an effort to accomplish some physiological process, which has become difficult or impossible; and though it may in some cases restore life to a child, it is likely, in many others, to prove insufficient.

It very often happens that a child born in a semi-asphyxiated condition, in consequence of a difficult labor, makes a few sudden and violent inspiratory movements, but would nevertheless succumb rapidly, were not the reflex action called into play, and did it not soon replace completely the pathological excitant, which, just before, had acted alone upon the spinal marrow. As the skin, in this state of diminished sensibility, is no longer stimulated sufficiently by the external air, special means should be resorted to whilst there is yet time to arouse the excito-motor action of the cutaneous nerves, and provided the asphyxia has not gone too far, they will often be crowned with success. But if the child is small and feeble, or if the causes of the asphyxia have acted for too long a time, the contractions of the inspiratory muscles are feeble and distant, and soon cease entirely; the heart, too, ceases to beat, and the child dies. Though, whilst the heart is still beating, we may succeed in exciting the reflex action of the muscles of inspiration, to the extent of producing a sudden inspiratory movement after every excitation, the symptoms of asphyxia remaining, however, unchanged, the child will die in spite of all that can be done.

If it be true that the impression produced by the external cold upon the skin of the body and face, is the first and only cause of the reflex action of the medulla oblongata upon the nerves of inspiration, and thus produces the first inspiratory act, we can readily understand that everything calculated to diminish notably or to destroy the cutaneous sensibility, will retard, or even render impossible, the first inspiratory effort, and reduce the fœtus to a state of apparent death. The causes of the latter are, therefore, such as paralyze to a greater or less extent the nervous centres, whose influence, though completely foreign to the maintenance of fœtal life, becomes indispensable to the establishment and continuance of extra-uterine existence.

Now, these causes are quite numerous; and, with the exception of a few, exert their destructive influence during the latter periods of labor. They may be divided into: 1, lesions of respiration; 2, lesions of circulation; 3, lesions of the nervous centres. The first are capable of producing various degrees of asphyxia; the second may give rise to a fatal hemorrhage as regards the child; the third affect the nervous centres directly, and render them incapable of performing the functions to which they are destined immediately after birth.

1. *Lesions of the Respiration.*— These are occasioned by everything which obstructs the respiration. Thus, there have been pointed out as occurring during labor, the compression of the umbilical cord between the sides of the pelvis and the head or body of the child; the winding of the cord so tightly around the neck or some other part, as to obstruct simultaneously the venous circulation in the brain, and that of the blood in the umbilical vessels; the premature separation of the placenta, whether it be inserted upon the neck or not, for since the separation necessarily produces the rupture of the utero-placental vessels, it renders the fœtal hæmatosis as impossible as does the compression of the cord; the great retraction of the uterus, when in delivery

by the breech the head only remains in the excavation, and the child is unable to respire; for this retraction renders the vessels of the uterus almost impermeable to blood. In all these cases, the asphyxia results evidently from a suspension of the placental respiration, and it is the contact of black blood with the brain, which paralyzes its action in the fœtus as well as in the adult.

Finally, it is plain that after the child is born, the accumulation of mucus in the nose, mouth, and air-passages, may also produce asphyxia by preventing the introduction of air into the bronchiæ; here, however, the mode of operation is precisely the same as in the adult, since it results from a mechanical obstacle to the introduction of the external air into the pulmonary vesicles.

In consequence of the action of some one of these causes, the fœtus may be born in a state of apparent death, and exhibit the very different symptoms which we have already mentioned; thus, in most cases, the surface of the body has a swollen appearance, and is of a violet, or rather of a blackish-blue color, the discoloration being more marked at the upper parts of the trunk, and more particularly on the face than elsewhere. The muscles are motionless; the limbs preserve their flexibility, and the body its heat; the pulsations of the cord, of the radial artery, and even those of the heart, are obscure or insensible.

Where a *post-mortem* examination is made, the vessels of the encephalon are found engorged with blood; at times, this fluid is even effused on the surface of the membranes, or into the substance of the brain itself, though most generally, says M. Cruveilhier, the effusion is limited to the surface of the cerebellum; sometimes it covers the posterior lobes of the cerebrum, but it is rarely found in the ventricles of the brain; and, in all the cases examined by him, there was blood enough in the cavity of the vertebral arachnoid membrane to distend the dura mater. Again, those congestions of the liver that are so common in infants, are then particularly apt to be met with; but, says Billard, they vary considerably as regards the quantity of blood accumulated in the tissues of the organ; for, in some instances, it is found there in such great abundance as to give rise to a sanguineous exudation on the exterior of the organ, the convex surface of which is discolored and moistened by a layer of effused blood, and I have even known an extravasation of this fluid into the abdomen to result from this turgescence. The lungs are also gorged with blood.

The external condition of the asphyxiated fœtus is not always such as we have just described, for, as M. Jacquemier has observed, nothing is more common than to find the fœtus born without any anomalous coloration of the skin, and even with a remarkable degree of pallor and flaccidity of the limbs; and this, notwithstanding the apparent death has been produced by compression of the cord. Can this difference be due, as M. Jacquemier supposes in the latter case, to a sudden suspension of the placental respiration, whilst in the former the cessation was slow and gradual? This explanation is probable, inasmuch as the same differences are observed in the asphyxia of adults, and as, according to M. Devergie, those persons who are killed by the falling in upon them of earth, present the same discolora-

tion of the integuments. The suddenness of the real death may explain the peculiarity under these circumstances; but it must not be forgotten that this external pallor is also the consequence of a slow but prolonged asphyxia, and that it often succeeds to the violet hue of the tissues; that we every day witness this succession going on before our eyes when the asphyxia has lasted too long, and that a child born with a very deep color, becomes rapidly pale and flaccid, if the means employed fail to excite respiration.

In the latter case, the discoloration of the tissues is the symptomatic expression of a more advanced stage: the pulsations of the heart, which before were sufficiently strong and rapid, become less frequent and feebler, return only at long intervals, and real death soon succeeds to the apparent one. Now these phenomena, which we observe occasionally, take place in the same manner whilst the fœtus is still contained in the womb, but is deprived of the placental respiration.

When, at the moment of birth, the asphyxia has lasted but a short time, the child will exhibit turgescence of the face, the violet hue of the skin, firmness of flesh, and frequent and regular pulsations of the heart; if a longer period has elapsed since the interruption of the fœto-maternal circulation, the child will be pale and discolored, and the pulsations of the heart and cord feeble and intermitting; finally, if the asphyxia has lasted longer than is compatible with the life of the heart, the child will be really dead at the time of its expulsion.

These two conditions, which are apparently so different, are due to the same cause, and are simply two degrees of asphyxia. Though in an etiological sense, no distinction can be made between them, they are important as regards the prognosis, for one is much more serious than the other, and, as regards treatment, the same means are not applicable to both.

M. Pajot informs me that he has found these observations to hold true as regards the adult.

2. *Lesions of the Fœtal Circulation.*—Ruptures of the cord or of the placenta may, of themselves, give rise to such a degree of hemorrhage as to endanger the life of the fœtus; fortunately, however, they are quite rare. When the hemorrhage is profuse, the child dies before the labor is over; but should anything happen to arrest the discharge of blood, the child may be born alive, but in a state of apparent death resembling syncope. The deficiency of nervous influence is here manifestly due to the fact that the medulla oblongata and the brain no longer receive a sufficient amount of blood to enable them to react upon the nerves of inspiration. The condition is a most dangerous one. The child is pallid, and its muscles are completely relaxed; sometimes, however, it makes a few short inspirations, and utters some very feeble cries; but if the hemorrhage has been at all profuse, it succumbs in a very short time.

3. *Lesions of the Nervous Centres.*—The cerebro-spinal system presides over none of those functions whose integrity is necessary to the maintenance of fœtal life; the respiration, circulation, and nutrition being subject exclusively to the nerves of organic life. These ganglions and their nerves derive from the arterial blood that principle of organic sensibility and motility which is necessary to the production of involuntary or automatic

movements, as also to the maintenance of the irritability and vitality of the organs. Although the fœtus possesses organs of animal life, its vitality is purely vegetative or organic. This fact serves to explain the life and development of acephalæ, for where the organs are absent, the functions are also wanting; yet these monsters are endowed with irritability, are capable of motion, and their life is preserved intact, until the termination of pregnancy.

Since the brain and spinal marrow have nothing to do with the performance of the fœtal functions, we readily foresee that any lesions which may affect them during pregnancy or labor, cannot disturb the harmony of those functions, or have any influence whatever upon the intra-uterine vitality. Therefore it is only after birth that the cerebro-spinal alteration or paralysis prevents the establishment of animal life, even though the organic life is still manifested by the integrity of the circulation, and even of the placental respiration. The first respiratory act is, as we have said before, the consequence of an excitement of the medulla oblongata, produced by the impression of the temperature of the surrounding air upon the skin of the new-born child. For this impression to be effectual, however, it is necessary that the sensation should be perceived by the central organ, which is rendered incapable of perceiving it by serious lesions of the cerebro-spinal axis. This important distinction should therefore be made between the various circumstances capable of reducing the fœtus to the state of apparent death, namely, that the fœtus may be destroyed in the womb by asphyxia and hemorrhage, whilst lesions of the nervous centres always cause it to be born in a state of apparent death.

We should also interpret in this way the effect which may be produced by the violent compression which the brain undergoes in certain cases of contracted pelvis; that which may result from the application of the forceps or lever under circumstances of difficulty; that which results from vascular congestion due to an obstruction to the return of venous blood in certain deliveries by the face; in cases where the cord is wound tightly several times round the neck, as also where it is strongly grasped by a spasmodic contraction of the neck of the uterus; and finally, to the compression sometimes produced by effusions of blood, either upon the surface, or into the substance of the brain itself.

So, also, is to be explained the mode of action of lesions of the medulla oblongata, such lesions as we know are easily produced by extreme rotation of the head, by tractions upon the head, or the pelvis when the head is arrested in an elevated position, and finally, by effusions at the base of the brain and upper part of the vertebral canal.

As lesions of the brain are not absolutely incompatible with the establishment of respiration, they are not so dangerous as those of the medulla oblongata. The destruction of a large portion of the encephalon has not always prevented the child from breathing and crying after its birth, and even from living for several days. A similar fact is presented by anencephalous fœtuses. By this we are advised that, in difficult labors, the temporary compression of the head may also suspend momentarily the action of the brain, but that as this suspension does not absolutely preclude respiration, the species of

shock or concussion which the brain experiences may pass away so soon as not to interfere with the continuance of life.

It is different, however, with lesions of the medulla oblongata, which is the only motor of the respiratory movements: it cannot be seriously affected without rendering extra-uterine life impossible. This explains the frequent death of children in pelvic presentations, when tractions have been made upon the trunk with the object of disengaging the head.

Treatment.—Since apparent death, however produced, may present the very different symptoms already mentioned, it is evident that mere inspection of the child can afford no information as to the cause of its condition. Although we regard the discoloration of the skin and relaxation of the extremities as signs of very grave import, it is impossible to determine the extent of the cerebral disorders, and consequently to foresee the result of measures calculated to restore the child. In this state of uncertainty, all cases should be treated as though they afforded a chance of success. The lapse of half an hour, an hour, or even more, from the time of delivery, is not sufficient cause for despair, since a number of facts may be mentioned going to prove that children have been in an asphyxiated condition for an hour, and were afterwards restored to life. Long continued silence of the heart, the entire absence of pulsations at the præcordial region, frequently determined at intervals, is the only sign which can be regarded as destructive of all hope. The heart is the *ultimum moriens*, and I do not believe that efforts to restore its pulsations, when once completely extinguished, have ever been crowned with success. But the softness and flaccidity of the tissues, and coldness of the body and face,[1] are no reason for abandoning the child, provided the heart still beats, however feebly, slowly, or irregularly.

When the child is born with a general injection of the capillaries of the face and trunk, when, in short, it presents the characters of the state formerly termed *apoplexy*, it is evident that the first indication is to relieve the engorgement of the head and lungs, which is done by promptly cutting the umbilical cord, and allowing a few spoonfuls of blood to escape, when the respiration is most usually established soon after, if there are no mechanical obstacles, such as mucus in the fauces, to the introduction of air into the lungs; and where these do exist, they may be removed by the extremity of the little finger, or with the feathered end of a quill; the blue and violet color of the surface will then be found to gradually disappear, and give place to a rosy hue, at first on the lips, then on the cheeks, and afterwards over the rest of the body. However, in practice, we sometimes find the circulation so enfeebled or benumbed, as it were, that the blood will not run from the umbilical arteries; its effusion may then be encouraged by plunging the child into a warm bath, or by squeezing the cord several times from its insertion towards the cut extremity; and where this does not prove successful in obtaining blood, some advise the application of a leech behind each ear. But as this application would occasion the loss of precious time, it is better to have recourse at once to other measures.

[1] The experiments of M. Brown-Séquard on warm-blooded animals, prove that the time for which they are capable of resisting asphyxia is greater in proportion as they are subjected to a lower temperature.

The small bleeding being practised or not, every effort should be made, by the use of various stimulants, to excite the sensibility of the skin, and the reflex action of the cutaneous nerves.

According to Marshall Hall, the best plan is to sprinkle the face and body of the child vigorously with cold water; immediately after which, it should be immersed in a warm bath, and then wrapped in warm flannels. The efficiency of this plan of treatment, which may be repeated several times, depends especially upon the rapidity with which it is executed. The impression of both the cold and heat should be sudden. Afterwards, the skin may be stimulated by frictions with the hand, or a brush, by dry flannel, or with any irritating liquors, such as vinegar or brandy; M. Moreau strongly recommends, and with reason, slight blows to be made with the palmar surface of the fingers upon the shoulders and thighs. In grave cases, I prefer flagellating the thorax and loins vigorously with a piece of wet linen. It is also often very useful to irritate the mucous surfaces. A little brandy or vinegar may be placed in the mouth, or the fumes of burnt paper blown into the anus. A feather may be dipped into vinegar and then introduced into the nose or fauces; this may be used at the same time to clear away the mucous secretions of the latter, which prevent the inhalation of air; and where there is reason to suppose that such secretions have accumulated to a considerable extent in the air-passages, the advice of Dewees should be followed, by placing the child on its belly, taking care to elevate the feet higher than the head, and at the same time gently shaking it, so as to clear out the trachea, and thus facilitate the introduction of air; "for," says the American author, "this is a measure of great utility, by which I am every way persuaded that I have preserved the lives of many children." After a few moments, the child should be again plunged into a warm bath, rubbed with warm flannels, and then immediately subjected to cold aspersions.

All these measures should be continued for a long time after respiration has been restored and become regular, in order to prevent secondary asphyxia.

The child's body may be exposed with advantage to a current of cold air, giving it at the same time a swinging motion, and even after it has been restored and dressed, its face may be exposed to the fresh air, or, what is better, fanned, for a short time.

It has been advised to make use of strong suction on the breasts, for the purpose of dilating the thorax mechanically, "which," says Desormeaux, "although without effect for the proposed object, appears to me admirably calculated to stimulate the muscles that move the ribs." But a more powerful remedy, highly extolled by the same author, is a sort of douche made by the mouth directly on the parietes of the thorax; this douche is performed by taking a mouthful of brandy and blowing it forcibly against the breast; and it is rarely necessary, he remarks, to repeat it many times, for it is found to produce a convulsive contraction of the inspiratory muscles almost immediately; the blood and air penetrate the lungs, and the respiration is irregularly established, being at first feeble and spasmodic, but soon becoming stronger and more regular. I have often used successfully with the

same object, a cold douche, produced by pouring a stream of cold water upon the præcordial region, from an elevation of about a yard.

If the excitation of the spinal and facial nerves is insufficient, the branches of the pneumogastric nerve should be acted on by insufflation.

This measure can now boast of such a degree of success, as to make it proper to have recourse to it whenever the means just mentioned have failed. M. Depaul has, in an excellent memoir upon the subject, completely refuted the objections urged against it, and confirmed by his experiments the previous results of Duméril and Magendie. Like them, he found that a false idea has been entertained of the powers of resistance of the pulmonary vesicles, and that it is necessary to blow much more strongly than is required to produce a simple dilatation, in order to effect their rupture. He has proved by instances, that children have been restored to life, whom the failure of the means commonly advised seemed to devote to certain death; also, that in cases where it was unsuccessful, because the lesions occasioning the apparent death were beyond the resources of art, it had the effect, when the pulsations of the heart had not ceased entirely, to render them stronger and more frequent, and sometimes even to determine a spontaneous though imperfect inspiration.

I would add, that long continued insufflation seemed to me, in three cases, to be more effectual than is claimed in the above paragraph, for not only did it excite spontaneous inspirations, but the respiration became gradually regular, and existence was prolonged for ten, twelve, and in one case for twenty-two hours, in spite of mortal lesions of the brain. Now it will readily be understood that, in very many cases, the family might attach great importance to twenty-four hours of life in a new-born child.

M. Depaul, who has rendered a real service in calling attention to a measure generally abandoned by some as dangerous, and by others as useless, also proposes some rules of conduct, which I think it right to mention briefly.

He uses Chaussier's canula, dispensing, however, with the lateral openings, and substituting for them a terminal one.

The child, whose temperature is to be maintained by warm coverings, should be placed with the breast higher than the pelvis, and the head thrown a little back, so as to render the front of the neck rather more projecting. Having cleansed the tongue and pharynx from mucus, the forefinger of the left hand should be conducted along the median line of the tongue to the epiglottis. The right hand holds the tube like a pen, and directs its small extremity along the finger to the opening of the larynx, inclines it towards the left commissure of the lips, and by gentle movements endeavors to raise the epiglottis; it is then only necessary to elevate the instrument, carrying it at the same time toward the median line, when its extremity will pass through the glottis. This is the only part of the operation which presents any difficulty, for it is not uncommon for the tube to enter the œsophagus. Before resorting to insufflation, we should make sure of its situation by passing the finger upon the larynx and trachea, and observing whether the larynx follows the instrument when the latter is moved from side to side. However, the first insufflation reveals the error immediately, for when the instrument has passed into the œsophagus, a considerable elevation of the

epigastrium precedes that of the base of the chest; if, on the contrary, it is in the larynx, the chest is dilated uniformly, and the epigastric projection is produced exclusively by the depression of the diaphragm.

To prevent the reflux of the air, and to oblige it to enter the air-passages, every point of exit by the œsophagus, mouth, and nostrils should be closed. The anterior wall of the œsophagus is applied against the posterior, by a moderate pressure with the instrument. The lips are pressed closely to the sides of the canula by means of the thumb and forefinger, whilst the nostrils are stopped by pinching the nose between the two middle fingers.

The insufflations should be quite near to each other. M. Depaul thinks that from ten to twelve should be made in a minute. The greater part of the air is expelled after each by the elasticity of the pulmonary vesicles; it may be useful, however, especially at the commencement, to render the expiration more complete, by pressure properly applied with the whole hand on the front of the chest.

The length of time for which it is necessary to continue the insufflations varies much. Thus, there are facts showing that sometimes a quarter of an hour has been sufficient, whilst at others, it was necessary to continue them for three-quarters of an hour, an hour, or even an hour and a half.

When, under their influence, the action of the heart has been so far restored as to be at from a hundred to a hundred and thirty times a minute, I think, says M. Depaul, that the physician should continue until spontaneous inspirations appear, and are repeated at the rate of at least five or six per minute; since to stop after the first one, would in many cases endanger the life of the child. When, however, after having awakened the pulsations of the heart, and even obtained some efforts at inspiration, all become more feeble and disappear, the insufflation may be dispensed with after the lapse of from ten to twelve minutes, for, under these circumstances, I have never known a child to be saved.

It is necessary to withdraw the canula from time to time, in order to clear it of mucus. When the trachea contains much mucus, which is manifested by gurgling, it may be drawn into the tube by suction, and the future insufflations be thus rendered more useful.

When spontaneous inspirations occur, the insufflations may be suspended for the moment.

Finally, all these means having failed, should a galvanic battery be at hand, currents of electricity might be passed through the muscles of inspiration; it is, however, an auxiliary upon which but little reliance can be placed.

Electricity has, in fact, much less action upon the fœtus than upon the adult. It has, for example, been proved by experiment, that well-developed fœtal serpents were but slightly sensitive to the action of galvanism before having breathed, whilst shortly afterward they were endowed with a very delicate sensibility.

The same measures should be used in cases of apparent death, in which the children are pale and colorless: here, however, far from allowing the umbilical cord to bleed, it should be tied instantly, even before dividing it.

Some persons have recommended that the umbilical cord be not cut in cases of asphyxia, until after the pulmonary respiration has been fully

established, hoping that the continuance of the fœto-placental circulation might replace the extra-uterine one that is wanting. Without admitting, with Dr. King, that this practice, by allowing the contractions of the heart to drive all the blood into the placenta, would expose the fœtus to death from loss of the circulating fluid, I think that in the majority of cases the precaution is, to say the least, useless, and even hurtful, by occasioning the loss of precious time. In fact, the placenta is almost always partly, or even entirely detached, shortly after the child is expelled; and even were this not the case, the retraction of the uterus following its expulsion, has so modified the circulation in the walls of the uterus and that of the utero-placental vessels, that the newly-born infant would certainly find its resources in that direction exhausted.

However, if the touch does not discover the placenta situated upon the neck, and, consequently, there is reason to suppose that it retains its normal relations with the womb, we may, when the fœtus is pale and discolored, defer cutting the cord, especially should it still exhibit pulsations.[1] As soon, however, as the pulsations have ceased, or it is ascertained that the placenta is detached, its section should be practised immediately.

Some children, after having cried and breathed quite freely, fall, after the lapse of several hours, and sometimes even days, into a state of apparent death, which soon terminates in real death unless assistance is promptly rendered. Therefore it is prudent to be carefully on the watch for the first few days. This secondary apparent death may be due, like that just described, to a true asphyxia, or to a deficiency of nervous influence, for which the stimulants employed immediately after birth have proved but a momentary remedy. Asphyxia may be produced either by a foreign body placed over the mouth and nostrils, or by an accumulation of mucus in the fauces. To remove the foreign bodies, and clear out the fauces with the aid of a feather, and the bronchia by exciting vomiting by tickling the palate, are the first measures to be used. If the face is of a violet color, a leech may be placed with advantage behind each ear, or, as recommended by Kennedy, upon the fontanelles. When the accidents are attributable to deficient cerebral action, the excitants already mentioned must again be had recourse to.

Excessive debility of the child, due to some one of the circumstances already pointed out, should be combated by the same means used for apparent death. In those cases where the infant is only very feeble, because it is born before term, or in consequence of a prolonged sickness on the part of the mother, very great care is requisite to maintain a high degree of temperature by surrounding it with cotton wadding and bottles containing hot water, since heat is then the best stimulant.

For the first few days, and sometimes even weeks, its alimentation demands some precaution. It is very important that a nurse should be procured at once, whose milk flows so easily that she can herself project a few spoonfuls into the mouth of the child; for its feebleness often renders the necessary

[1] From experiments made by Budin, the amount of blood escaping from the placental end when the cord was tied immediately after the birth of the child was found to be about three ounces greater than when a delay of several minutes was allowed, which shows a loss of that much blood which would otherwise pass into its circulation. It has also been shown by Hofmeier and others that there is less loss in weight in the new-born infant when the cord is not tied until the pulsations have entirely ceased.

effort at suction impossible. It is equally important to give it only the first milk, which is easier digested.

Umbilical hemorrhage of spontaneous origin has been noticed by some authors. Dr. J. S. Gibb has recently written a monograph upon it (*Philadelphia Med. Times*, May, 1884), in which the great fatality is shown, and the difficulty of treating it locally is considered. The hemorrhage may occur at any time. The blood is usually non-coagulable. The causes are involved in obscurity. It is usually associated with jaundice and the hemorrhagic diathesis.

CHAPTER IX.

OF THE PHENOMENA APPERTAINING TO THE LYING-IN STATE.

THIS term (or that of the *puerperal condition*) is applied to the period immediately following the delivery, during which the uterus and genital organs, and indeed the whole economy, gradually return to their ordinary condition.[1]

The attendant phenomena may be divided into the natural, and the unnatural or morbid, including under the latter head all the diseases to which the lying-in woman is exposed; but the former only claim our attention here.

A feeling of depression, or lassitude, such as that experienced after an unusual or an immoderate exercise, succeeds the agitation caused by the labor; and it not unfrequently happens that the patient has scarcely reached her bed, when she is attacked by a chill, severe enough at times to produce a chattering of the teeth; but this soon passes off, the pulse increases in strength, the heat of the surface returns, the skin becomes humid, a salutary moisture appears, and the various functions are re-established, while the most perfect calm and the most delightful slumber replace the past disorder. Now, although this slumber of the patient is to be respected, nevertheless it is desirable that it should not take place until a few hours after the delivery, unless the physician should be at hand to watch attentively over the state of the circulation, and the condition of the womb during this recuperative repose, because some women have been attacked when in this state with internal discharges, and have awakened exhausted by the loss of blood. Therefore, although on account of the rarity of this accident the patient should not be prevented from sleeping, it is necessary to watch over her during her slumber, or at least to have her carefully observed by an intelligent nurse.

After the first nap is over, she might sit up in bed a few moments to take a little broth, as this position refreshes her, and also facilitates the escape of the lochia that had accumulated in the vagina. The patient is the more enfeebled as the loss of blood has been greater, or the duration of the labor prolonged.

The nervous susceptibility is also highly exalted, and the skin, whose activity was diminished during gestation, now regains a more exalted vitality; it is soft, humid, and is always covered with a dewy perspiration during the first week. This sweat is sometimes very abundant, particularly when she is too warmly covered, and it is not at all unusual to find it followed by a miliary eruption and a distressing pricking sensation. Such eruptions were

[1] The process by which the uterus returns to its ordinary non-puerperal condition is known as *Involution*.

exceedingly frequent in former times, when it was thought useful to *push the skin*, as it was called, and to make the woman perspire by surrounding her with thick coverlets; now, on the contrary, they are quite rare, and where they do show themselves, are easily made to disappear by taking the necessary precautions to diminish the cutaneous secretion.

[After delivery the pulse becomes softer, fuller, and soon slower. We propose, however, going somewhat into detail in reference to this subject, for the examination of the pulse in newly-delivered females is of such capital importance that by simply paying attention to the information which it affords, we are enabled to diagnosticate almost certainly a state of health or of disease. The study of the pulse, therefore, yields extremely valuable information to the accoucheur, but we cannot in this place treat of the indications which it supplies in puerperal diseases, and shall confine our attention to the changes which it undergoes in a healthy woman after delivery.

We would state in the first place, that the mean rate of the pulse in adult women is about seventy-five per minute, and becomes somewhat more frequent during pregnancy (see page 157) and especially during labor (see page 286).

Immediately after delivery the pulse falls to some extent, but the diminution is generally followed in a short time by an acceleration, which lasts for several hours.

In healthy women, this transient acceleration is very often followed by a second diminution in pregnancy. Without attempting to state the exact proportion of cases in which retardation is observable, I will only remark that it is so extremely common as to be found almost constant when sought for carefully.

The diminution in the frequency of the pulse has been well studied and described by H. Blot, in a memoir of which we give an analysis (*Archives Générale de Médecine*, May, 1864.)

The greatest diminution of frequency observed by M. Blot, was thirty-five beats per minute. "But," says he, "it must not be supposed that so great a difference is common, — for I have met with it in but three cases. Between thirty-five and sixty-five beats per minute, the latter of which we regard as the standard, we have observed every grade of diminution. Two numbers, however, forty-four and fifty-six, have impressed us by their relative frequency."

The slowness of the pulse may continue from one to twelve days, generally lasting longer in multiparæ than in primiparæ. In the latter, it rarely continues longer than three days, whilst in the former it is often observed for four, six, and seven days.

The time at which it comes on varies somewhat in different women, though it generally is observable within twenty-four hours after delivery. In the twenty-four hours following its appearance, the slowness of the pulse increases; then, after remaining for a time stationary, gradually gives place to the rate which is habitual to the woman.

The slowness diminishes and sometimes even ceases entirely as soon as the breasts experience the congestion which precedes the secretion of milk. Usually, however, the pulse gradually becomes more frequent. We shall have occasion to revert to this fact when we come to treat of the secretion of the milk and what is known as the *milk-fever*.

The slowness occurs also after abortion and after premature delivery, whether spontaneous or artificial.

When the slowness of the pulse is observed in a newly delivered woman, we may feel sure that she is in a perfectly normal condition, so that in respect to the prognosis it is an extremely favorable sign.

In a lying-in hospital, the frequency of the diminution of the pulse in proportion

to the number of puerperal women indicates, in a general way, an excellent sanitary condition: its rarity, on the contrary, should excite our apprehension of an unhealthy tendency in the newly delivered inmates.

The cause of this slowing of the pulse is obscure. It would seem, however, from the sphygmographical experiments of MM. Blot and Marey, that, like the diminution of frequency under all circumstances, it is connected with a certain increase in the tension of the arteries, which tension the authors just quoted think may be explained by the sudden and almost entire suppression of the circulation which existed in the uterine walls during pregnancy. When the uterus contracted, the blood which previously traversed it accumulated in the arterial system, from whence resulted a greater tension which became in its turn an impediment to the ventricular systole, giving rise to the temporary diminution in frequency of the pulse, followed by an establishment of equilibrium.

Whatever the explanation, the fact is both established and shown to be of great clinical importance.]

Credé has shown that a rise of temperature may take place at any period from any temporary cause, such as constipation, mental disturbance, errors of diet, etc. Should there be a rise, however, above 100° F., some complication would naturally be expected.

If the relaxed walls of the abdomen be examined after delivery, the womb is felt above the pubis as a large tumor, which henceforth diminishes in size. In thin women, particularly those who have often had children, the womb still remains at the end of two weeks about two fingers' breadth above the pubis, yet the fundus in primiparæ, more especially in such as are at all inclined to embonpoint, cannot be distinctly felt after a week; and by the end of the sixth week this organ has nearly regained its primitive condition, being still, perhaps, a little larger than usual.

[The diminution of the bulk of the uterus, its atrophy, so to speak, has been studied so carefully by Dr. Wieland, who noted its progress day by day, that we think we cannot do better than quote some portions of his excellent thesis, which are of interest in connection with the subject under consideration.

At the commencement of labor, the organ has generally an elevation of from eight to nine inches above the pubis, and from six and a half to seven and a half inches in width. When the clots which follow the exit of the placenta are expelled, the uterus is found to have assumed a spheroidal form, and is hard, resisting, and contracted. Its vertical diameter is then only about from four and a half to five inches, and its transverse diameter from three and a half to four inches. After about half an hour and during the first few hours succeeding delivery, its size increases somewhat,—(vertical diameter, five to five and a half inches; transverse diameter, four and a quarter to four and three quarter inches;) but thereafter it diminishes gradually and almost uniformly. On the second day the decrease in the diameters amounts to from three-eighths to five-eighths of an inch, the vertical then being often rather less than the transverse. On the third day, in most cases, little change is observable except in women who have had in the interval of the two last examinations severe after-pains, accompanied by an abundant lochial discharge when the contraction takes place. Dr. Wieland observed that until the middle of the fourth day the size of the uterus was unchanged but seemed softer and less regularly rounded in form, and that this inactive condition always coincided with the commencing lacteal secretion. From the end of the fourth day the retrocession of the organ progressed regularly and continuously. The distance which then separates the uterus from the pubic symphysis varies from two and three-eighths to two and seven-eighths of an inch, and in exceptional cases only is it less

During each of the following days the observed difference varies from three-eighths to three-sixteenths of an inch.

By the sixth day the uterus has become hard, its anterior surface less convex, and its fundus reaches from an inch and a half to two inches above the superior strait. Usually not before the tenth day, and sometimes not until the eleventh, has it disappeared behind the symphysis pubis; but even then, if the abdominal walls are very thin upon the median line, the fundus may be felt in the pelvic cavity by pressing downward with the bent fingers.

During all this time the tendency of the womb, which in the majority of cases (79 in 100) is situated to the right, is to resume its position in the median line.

The organ, however, is far from having attained its primitive condition, even when the hand is unable to feel it through the abdominal wall; and its state can be determined only by the vaginal or rectal touch.

The laxity of the ligaments, the mobility which it still retains, and its diminished size, cause it to settle into the excavation, so that its inferior segment, still considerably developed (being nearly an inch and a half or two inches in diameter), depresses the vaginal cul-de-sac. The neck is lower down in the vagina, and the posterior surface of the organ is felt to be hard, convex, and of a size which can only be approximatively determined. The absorption seems now to go on more slowly, so that no sensible difference can be perceived for eight or ten days longer. By this time its volume is slightly lessened, there is less depression of the vaginal cul-de-sac, and it is more movable. Finally, in women whom I examined three months after delivery, the original condition, as respects situation, form, direction, consistency, and mobility, seemed to be restored, the size only appearing to be somewhat greater. In no case had it resumed entirely its primitive condition either by the sixth week or the second month. (Wieland.)]

The rapidity with which the uterus after delivery tends to resume the volume and dimensions which it possessed before impregnation, is, to say the least, quite as surprising as the rapidity with which it underwent its enormous hypertrophy during gestation. An examination of the various changes through which this rapid absorption is effected, induced M. Retzius, of Copenhagen, to conclude that it is preceded by a fatty degeneration of the muscular fibres. The same observations have also been made by Kolliker.

This diminution in the size of the uterus is not always so regularly graduated as described, for when the contractility of the tissue has been feeble after delivery, the walls of the uterus often preserve a considerable thickness for four or five days, the fundus being found all this time close up to the umbilicus. The same observation may be made at a still later period, in cases where an inflammation of the peritoneum, of the uterine mucous membrane, or of the neighboring organs has supervened. Again, it happens that, after having been diminished, its volume augments anew, for some hours, at times, even for a day or two, and then soon returns to its former size. I can explain this circumstance only by supposing some local congestion, which has not been acute enough to produce an active hemorrhage, but whose action has been limited to distending and engorging the uterine vessels, and consequently to increasing the thickness of the walls; or this abnormal volume may be owing, in certain cases, to the presence of newly formed coagula. But, however that may be, I felt bound to point out these anomalies, to prevent the inexperienced practitioner from falling into error.

[The internal surface of the uterus after delivery, has lately been studied care-

fully by MM. Colin, Robin, Pajot, and Béhier. Two parts, dissimilar in appearance, may be distinguished in it; one of these, which is extensive, was in relation with the decidua during gestation; the other, having a lesser surface, presents traces of the insertion of the placenta. We have next to study these two parts in succession.]

A few hours after delivery, says M. Colin, the internal surface of the womb is covered with clots of blood, which, upon being removed, discover a soft, moist, reddish layer, lining the whole internal surface of the uterus, except where the placenta was attached. If the surface be scraped with the blade of a scalpel, a layer varying in thickness from the one-eighth to the one-sixteenth of an inch may be raised from it. This layer, which increases in thickness towards the middle and fundus of the organ, is of a reddish-gray color and friable, tearing like a newly-formed pseudo-membrane, and even giving way beneath the fingers. Below it is found the muscular tissue, of a white or grayish appearance, entirely distinct from this layer, and easily recognized by its clearer hue, the appearance of fibres and their transverse direction, as also by its greater consistency.

It is now demonstrated that this membrane is formed by a new uterine mucous membrane in process of regeneration from the fourth month of gestation. (See page 177.)

At the upper boundary of the cavity of the neck, this membrane is terminated by an irregular edge projecting above the latter, and from which are put forth small shreds or laminæ, from one to three-sixteenths of an inch in length, of the same nature as the layer covering the wall of the uterus.

The cavity of the neck contains a glutinous, transparent, and slightly-reddish mucus. The color of its internal surface varies greatly according to the mode of death, from a reddish-gray to a blackish-brown. The thickness of the mucous membrane lining the cavity of the neck varies from the one-thirty-second to the one-sixteenth part of an inch; it is very moist and flexible, although firm and torn with difficulty. It remains intact, and does not participate in the exfoliation which that of the body undergoes.

The condition of the mucous membrane at a period still more remote from delivery, has also been studied by M. Colin. Not until after about the ninth day are epithelial cells found upon the surface of the uterine mucous membrane in process of restoration. Until the twentieth day its tissue is composed chiefly of fusiform bodies, nuclei, and granules; glands and numerous capillary vessels are found in it about the twentieth day. Thus, from the twenty-eighth to the thirtieth day, the membrane has assumed a rose-red or grayish color, especially in the vicinity of the neck; it is smooth, moist, and soft, but resists the action of a stream of water, though it may be scraped off entirely by the scalpel, so as to expose the muscular fibres. Numerous vessels, whose greatest diameter does not exceed the one-ninetieth part of an inch, proceed from the muscular tissues and ramify *ad infinitum* in its substance. By the fortieth day, the membrane is of a rather deep-red color, opaque, and of about the one-thirty-second part of an inch in thickness, toward the fundus; it is semi-transparent and thinner in the lower part of the body, where it is continuous with the mucous membrane of the neck, which presents no peculiarities. It is soft, and easily removed by the back of a scalpel. It

is traversed by a very close network of capillary vessels. By the sixtieth day, it is smooth, gray, and supplied with small vessels; it has the true consistency of a mucous membrane, and the scalpel removes from it but a slight pellicle, which has no longer the pulpy appearance of the substance detached from it at an earlier period.

This new mucous membrane, which, according to M. Robin, begins to be formed by the fourth month of gestation, is, therefore, after delivery, the seat of a reparatory process, which ends in the completion of a new mucous membrane. The mucous membrane of the neck is not thrown off; it is simply hypertrophied during pregnancy, and after delivery continues to exhibit the arbor vitæ, though of a somewhat modified form.

The point of attachment of the placenta is marked by an elevation, presenting to the view a surface mammillated, rounded, anfractuous, and projecting to the extent of a quarter of an inch above the level of the surrounding surface. The anfractuosities are filled up with coagulated blood, which is removed from them with difficulty. It is the placenta wound.

These inequalities, which have been regarded by some anatomists as tufts destined to dip down between the cotyledons of the placenta, are due, according to Desormeaux, to the excessive distention which the arteries and veins, the last especially, have undergone during pregnancy, and upon the slowness of their subsequent retraction; though, according to Velpeau, they are owing, in women that die shortly after delivery, to the swelled and fungous character of that portion of the internal uterine surface which corresponded to the placenta. We prefer the following explanation, given by M. Jacquemier, viz.: the internal muscular layer of the womb is perforated in all the space occupied by the after-birth, by a great number of holes, which give a peculiar aspect to this portion of its inner surface, and render it less contractile than at other parts; and consequently, as the organ retracts, it has a tendency to project into its cavity, and when it arrives at the final state of repose, a tumor is formed, which is ordinarily larger than the palm of the hand, with a very irregular lacerated surface, spongy, as it were, in character, and often standing out in considerable relief; the torn utero-placental vessels are comprised in this mass, which renders them tortuous and nearly inextricable. But whatever the explanation may be, it is highly important, adds M. Jacquemier, to bear this arrangement constantly in mind, for an attentive perusal of several cases of artificial delivery of the after-birth, has convinced me that, in those instances, the tumor formed by the most internal layer of the womb was mistaken for debris of the placenta, which the medical attendants endeavored ineffectually, though not without danger, to extract.

[Robin has shown that this projecting portion is formed simply by the utero-placental mucous membrane, which remains adherent to the uterine wall, with the exception of the thin superficial layer which was carried away by the placenta. (See *Decidua*, and *Placenta*.)

The retraction of the uterus after delivery diminishes greatly the superficial extent of this part of the mucous membrane, being soon reduced to a diameter of from two and a half to three and a quarter inches, and so progressively. At first it was circular in form, but soon becomes irregularly oval, with the greater diameter

corresponding with the longer diameter of the uterus. What it loses in length, however, it gains in thickness by the contraction of the organ. A few days after delivery, it has a thickness of from five-eighths to six-eighths of an inch, and in some places even more. At the same time, its surface becomes folded and roughened, and its substance brownish or reddish; it also softens gradually, and assumes a pultaceous or mucous consistence. Its projecting and irregular edges are continuous with the thin, newly-formed mucous membrane which lines the remainder of the uterus.

It is not uncommon to find on the surface of the part just described vascular orifices plugged up by reddish or bleached clots, and if the latter be traced by dissection into the deeper parts of the membrane, they will be found to lead into the subjacent uterine sinuses. The cavernous appearance given to this layer by the membranous anastomoses of its vessels is very striking, and one cannot but observe at the same time that its thickness and the projections which it forms upon the internal surface of the uterus are principally due to the clots which fill and distend the sinuses to a greater or less extent. If the latter be emptied, the intervals between them will become very slight.

The clots lose their color and lessen gradually, but they are still found up to the twentieth day after delivery, and often much later. The tissue of the serotina itself atrophies, and finally becomes continuous with and indistinguishable from the newly-formed mucous membrane. In some women, however, the mucous membrane remains for several years both thicker and more projecting at this point than elsewhere. It was a mistake, therefore, to suppose, as has been heretofore done, that the serotina is carried away with the placenta, or that it is exfoliated and eliminated during the continuance of the lochial discharge. (Robin.)

In autopsies of puerperal fever cases, the layer, with a reddish, flocculent, blackish and pultaceous appearance, formed by the serotina, has often been mistaken by persons not fully acquainted with what had taken place previously, for portions of the placenta remaining adherent to the uterus, and then in course of decomposition.

To recapitulate: At the moment of labor there is already present a newly-formed but very thin mucous membrane between the muscular layer of the uterus and the parietal decidua. The new membrane makes its appearance at the fourth month, but does not continue to grow between the muscular layer and the utero-parietal mucous membrane. Finally, when the placenta is detached, the greater part of the serotina remains adherent to the uterus. This utero-placental mucous membrane does not, therefore, deserve the name of decidua, inasmuch as it continues and diminishes gradually in thickness until its surface corresponds with that of the recrudescent mucous membrane.]

Professor Stoltz has studied the modifications that occur in the neck of the uterus, after the delivery, with a great deal of care, and we extract the following passage from his excellent thesis on this subject: "As soon as the child is born, the cervix is partly formed anew, but it is soft, short, wide, and irregular, and one or more fingers can easily be made to penetrate it; the internal orifice offers the greatest resistance, as is proved when an attempt is made to introduce the hand into the womb, for it enters with considerable difficulty, and only when this orifice has been progressively dilated. The latter is sometimes so contracted as to induce inexperienced persons, who endeavor for the first time to carry the hand up into the womb, to believe they have succeeded, when in fact they have only reached the dilated vagina, where they find a large cavity, but no opening to get any further, and the clots of blood, then collected at the upper part of the vagina and around the cervix, add still more to this confusion.'

The internal orifice, formed after the expulsion of the child, offers but little resistance; and, consequently, it has scarcely occasion to dilate again for the passage of the placenta, as it yields readily; and when the delivery of the after-birth is effected, the womb contracts, and the neck becomes longer and more consistent; although it must again open several times to permit the numerous clots of blood to escape. During the lying-in, it gradually returns to its natural size; sometimes, even, it is longer; but it acquires the ordinary disposition more or less, as it regains its proper consistence, and by the end of the first month it generally exhibits about the same dimensions as it had prior to gestation; at times, however, it is a little shortened, and the consistence is nearly as firm as usual, although the inferior part has seemed to us rather more softened. It no longer presents a conical shape, but is more cylindrical, from the fact of the summit having become larger. As a general rule, the scars on the lips are proportionably more numerous as the patient has had a greater number of children, and her labor has been more tedious. The transverse fissure is deeper and more angular; and, in such women, the upper part of the cervix is sometimes larger than the base, though it is much shorter than usual, and at times is divided into two lips that are more or less flat, broad, and unequal, and the anterior of which is longer than the posterior; indeed, in some cases the latter seems to have been altogether destroyed, while in others it is well marked, and the anterior one is scarcely perceptible. In fact, almost as many varieties exist on this point as there are different subjects.

The vagina becomes shorter, and the ridges that were effaced during the last stage of labor, gradually but slowly reappear, and the orifice of this canal, and the vulva, also regain their primitive condition. At first, the labia externa, as well as the perineum, are thin and distended, and the posterior part of the contour of the vulva is flabby, wrinkled, and projecting outward. Sometimes the epidermis is fretted, at others, actual lacerations are found, which produce a smarting sensation; and as to the fourchette, it is almost inevitably torn in the first labor.

The broad ligaments seem to re-form by the approximation of their two constituent layers, while the round ligaments gradually become shortened and retracted.

The abdominal muscles and integuments, which were at first soft and flabby, and exercised but a very imperfect pressure on the viscera and vessels contained in their cavity, again retract; although this process is very often incomplete in women of a soft fibre, or who have had many children.

This slow and gradual retraction of the uterus takes place, in some instances, without the least pain, and without the knowledge of the patient; but it more generally becomes intermittent and distressing, and as the sufferings the women then experience have a great analogy to those of childbirth, they are called the *after-pains*. At the same time, a more or less abundant discharge takes place from the vulva, consisting at first of pure blood, then of blood mixed with a white fluid, and, lastly, of a white seropurulent liquid; and these discharges have received the name of the *lochia*. Finally, a function altogether new sets in, in the course of the first few days, which may be considered as the complement of the puerperal functions;

this is the milk secretion, whose onset is attended by certain general phenomena, which are ordinarily described under the term of the *milk fever*, we shall therefore have to examine, in turn, these three principal phenomena of the lying-in state.

§ 1. Of the After-Pains.

The after-pains are certainly occasioned by the contraction of the womb, to be satisfied on this point, it is only necessary to place the hand over the hypogastric region, when we will ascertain that the uterus becomes harder just at the moment when the patient complains the most. These pains are much more frequent and intense in women who have borne many children than in primiparæ; as, also, after an easy than after a long and painful labor; and when the womb incloses some foreign body, such as coagula, or a portion of the membranes or placenta, than when its cavity is entirely empty. Now, all these differences in character will be readily comprehended, if the reader will only bear in mind that the object of the contractions is to express from the uterine parietes those liquids with which the walls are still engorged after the delivery, and to expel from its cavity all the foreign substances contained therein; that, in very prompt labors, the organ, from being evacuated too rapidly, does not retract so perfectly as it ought, and allows the blood to coagulate and accumulate in its interior, and that the very feeble contractility of its tissue forces out but very imperfectly the fluids remaining in the thickness of the walls.

The pains generally commence soon after the delivery, being at first feeble and distant, then more frequent and painful; and, at the moment of their occurrence, the uterine globe retracts, becomes harder, more resistant, and sometimes even seems to rise up, by resting on the posterior plane of the abdomen, as a *point d'appui*, and projecting in the form of a globular tumor through the walls of the abdomen. The escape of the lochia is ordinarily more abundant towards the end of, or just after each pain, and not unfrequently a few small coagula come away from the vulva; but where the uterus contains a large one, the pains constantly increase in force and frequency, until it is expelled, after which they again diminish. In most cases, they cease during the milk fever, though they may continue for the first seven or eight days. They are very commonly excited by putting the child to the breast. Sometimes they return after having entirely disappeared, are followed by the discharge of a little blood from the vulva, or the expulsion of a clot, or of a portion of membrane that has remained in the uterus, and then everything returns to its natural condition. They are sometimes so severe as to extort cries from the patient, and some women insist that they suffer more from them than from the labor pains.

As regards the diagnosis, it is highly important to distinguish the after-pains from those caused by peritoneal inflammation, but fortunately this is not very difficult; for however strong the after-pains may be, they are generally intermittent, and are separated by an interval of variable duration; besides, the distress attendant upon them is rather alleviated than augmented by pressure, and a rather more abundant lochial discharge accompanies or follows them. While they last, there is an absence of febrile movement;

finally, when the child seizes the nipple, especially if the latter is the seat of any ulceration, the suffering thereby caused most frequently brings on an after-pain, and this circumstance alone has often sufficed to make them reappear, even after a suspension of several hours. When existing, these differential characters are quite sufficient to distinguish them, but unhappily they are not always so well marked; for, where they are very acute, or follow each other in rapid succession, they are accompanied by fever and sharp pains in the hypogastrium. But even then, there is always a remission, which, conjoined with the absence of the other signs of peritoneal inflammation, may aid in determining their character.

Dr. Dewees states that he had several times an opportunity of observing a singular pain which was manifested almost immediately after the delivery, and yet was altogether different from the ordinary after-pains. It is a very acute pain, referred by the patients to the lower part of the sacrum and coccyx. It commences as soon as the child is born, and continues without interruption, and of a frightful intensity. It is declared by the patient to be vastly more insupportable than the after-pains, for it is quite as violent, besides being constant; the latter character serving as a ready means of distinguishing it. Camphor and opium appeared to him the most successful means of relieving it.

The after-pains, of which we have just spoken, are sometimes so severe as to claim the attention of the physician, and although they may be useful when caused by the retention of a foreign body, they are so annoying, that it is certainly advisable to endeavor to prevent them. Dewees states that this may often be effected by observing the following precautions: 1. Do not rupture the membranes before the neck is completely dilated; 2, after the head is born make no tractions, but allow the uterus to expel the shoulders and trunk; 3, do not extract the placenta until the womb is thoroughly contracted; 4, after the placenta is delivered, excite the womb so as to oblige the muscular fibres to contract as much as possible. It is evident that all these measures have for their object to insure the slow and complete contraction of the walls of the uterus, in proportion as its contents are expelled.

In the cases of women who have suffered much from after-pains in previous confinements, I have made it a practice to administer a few doses of ergot immediately after delivery, with the effect, I have thought, of preventing their occurrence in many cases, or at least of lessening their violence. When the womb contracts feebly, it has seemed to me of advantage to add pressure upon the uterus to the use of the ergot. This is done by means of the ordinary bandage, and made more effectual by placing a compress, formed of one or two folded towels, upon the fundus of the organ.

If the after-pains are feeble, nothing need be done; if, however, they are very violent, the physician should interpose. Provided the patient has not suffered from hemorrhage, or been threatened with it, we may begin by placing warm and emollient cataplasms upon the abdomen. Lotions containing laudanum may be used upon the belly, and the cataplasm may be wet with the same substance. An injection may also be given of from twenty to forty drops of Sydenham's laudanum, in as small an amount of vehicle as possible. Dewees professes to have derived great advantage from

a camphor mixture, consisting of a drachm of camphor to six ounces of vehicle, a tablespoonful to be taken every hour or two. When the mixture disagrees with the patient, ten grains of finely-powdered camphor, every hour or two, mixed in a little syrup of any kind, may be substituted for the julep just mentioned. When the after-pains are accompanied by signs of general plethora, blood may be taken from the arm. Finally, should there be cause to suspect the presence of large clots or portions of the membranes in the cavity of the uterus, one or two fingers may be introduced within the neck, in order to seize them, or at least to bring about their expulsion. These are, perhaps, the only circumstances under which the use of ergot, so highly vaunted by Crozat and Velpeau as a remedy for after-pains, is likely to be successful.

§ 2. Of the Lochia.

Of all the various excretions that take place after the delivery, the lochia are certainly the most interesting to us as practitioners. This name is applied to the matters that escape from the vulva during all the period from the delivery of the after-birth until the womb has regained its normal size and consistence. Immediately after the delivery of the placenta, and the escape of the accompanying blood, all further sanguineous discharge becomes temporarily suspended, probably because the blood that transudes from the surface of the womb accumulates in the cavity of that organ; but the pure fluid soon begins to flow again, although, in the course of twelve or fifteen hours, it loses its consistence, and its color becomes lighter, and after a short time it is changed into a bloody serosity. At the expiration of the first day, the fluid secreted contains only about one-third part of red globules; the other elements consisting of white globules in rather smaller proportion, and very numerous epithelial cells. The suspending fluid is sprinkled with grayish molecular granules and granulations of fatty matter. After the second day, the proportion of white globules increases, and the red ones diminish or even disappear. The secretion of milk soon commences, and then the flow of the lochia is either diminished or entirely suspended. When it is over, the bloody discharges reappear, and continue during the four or five succeeding days, though with characters varying greatly in different individuals: thus, in some women, those especially who menstruate profusely, they appear with the same characters, quantity excepted, as before the milk fever. They are still composed of pure blood, which sometimes contains numerous small clots; with the majority, however, they become more and more serous, though still exhibiting here and there some bloody streaks, or perhaps are slightly tinged by the blood, the quantity of which diminishes every day. It usually disappears altogether about the eighth day; the lochia being thenceforth composed of a more or less consistent yellowish-white liquid, and they thus continue for two or three weeks or a month; though in some women, who do not nurse, they do not pass off until the menses reappear, that is, in about six weeks or two months after the delivery.

These discharges have been divided, according to their color, into the *sanguinolent*, the *serous*, and the *milky*, *puriform*, or *purulent* lochia. As the uterus retracts, its walls gradually disgorge the fluids they had imbibed,

and these naturally run towards its central cavity. So long as the large venous canals in its substance are not empty, the discharge consists of pure blood; somewhat later, it is composed of serum, together with the detritus of the ovum and the mucosities of the organ; and still later, a true suppurative irritation is established, the products of which, analogous in some respects to the non-contagious discharges of the urethra, constitute, in a great measure, the white or the purulent issue.

The lochia have a peculiar odor, called *gravis odor puerperii*, which varies in strength according to the individual and her habits of cleanliness; and to this is also added the scent from the perspiration and the milk, which latter, distilling from the breast, is imbibed by her garments and turns sour. Sometimes the lochia become fetid, and where this circumstance is not owing to slovenliness, it is always an unfavorable sign, since it most generally announces that coagula or some other foreign substances are putrefying in the uterus; and where the lochial fluid has the color of coffee-grounds, and a cadaverous smell, it is almost uniformly an evidence of the existence of an inflammation of the womb or vagina, which has terminated in gangrene. Again, whenever the patient is afflicted with carcinoma uteri, the discharges resemble the washings of flesh, and have a very nauseous smell. In all such cases aromatic injections, infusions of elder or chamomile flowers, which are rendered more useful by adding some disinfecting fluid, should be made several times a day.

The lochia are also very variable in quantity and duration, though we may state, as a general rule, that the patient soils ten or twelve napkins in the course of the first twenty-four hours, eight on the second day, six on the third, four on the fifth, and two on the following days. After the milk fever is over, the flow diminishes more and more, its amount being usually proportionate to that of the menstrual evacuation. It is more copious in women who have borne many children, or who make use of an overnourishing or a heated regimen, and in those who do not nurse. The sanguineous discharges vary much in amount during the first days, according to the force of retraction with which the uterine walls were endowed immediately after or during the delivery of the after-birth; thus, at times, they are very copious, frequently coinciding with a considerable development of the organ; and in such cases I have known the womb to continue as high up as the umbilicus for several days after the delivery.

This condition, which Leroux calls humoral engorgement, depends, in his estimation, on the fact that the vessels and pores of the womb, from being distended with blood, do not become empty as soon as usual, because the contractility of tissue is not then active enough to expel it; for the walls of the uterus constitute a true sponge, whose meshes are composed of muscular fibres, and which must retract forcibly so as to express all the liquids contained in the vessels and vacuities which they form; hence, if this contraction is not strong enough, the parietes remain engorged, and preserve an abnormal thickness, which singularly augments the whole volume of the uterus, although its cavity may be entirely effaced. Soon, however, the contractile action of the tissue is aroused, and the muscular fibres forcibly compress and flatten the vessels that ramify between them, and thus force the liquids

which had hitherto remained there to discharge into the cavity of the organ, whence they flow towards the exterior in considerable quantities. This discharge might very readily be mistaken for a flooding, occasioned by a retention of some part of the after-birth, or of voluminous coagula, the more especially as it is accompanied at times by sharp after-pains; but if one finger can then be introduced into the uterus, the accoucheur will ascertain that it contains no foreign substance, and by placing the other hand at the same time on the hypogastric region, he will easily satisfy himself that the unusual size of the organ depends only on the engorgement of its walls. In these cases, there is nothing to be done, as the sanguineous discharge is itself the best remedy; for it slowly empties the uterine texture, diminishes the after-pains, and the womb gradually returns to its normal size.

This slowness of the retraction also prolongs the flow of the sanguineous lochia, and the same result is observed whenever one of the layers of the uterus or its enveloping cellular tissue is affected with inflammation. Indeed, we can readily understand that from this sluggishness of the uterine fibres, this defect of reaction, as Leroux called it, to a more or less perfect inertia of the womb, there is but a single step, and that a secondary hemorrhage might result from the absence of contractility, if it were carried to the extent of relaxation.

[The time at which the lochia assume a purulent form is also liable to remarkable variations. In thirty-seven cases observed by M. Béhier, in which everything was favorable, it occurred on the third day nine times, on the fourth day four times, on the fifth day ten times, on the sixth day six times, and from the seventh to the tenth day seven times. Finally, in one case, in the most auspicious condition, the lochia became decidedly purulent only on the sixteenth day. (Béhier, *Clinique Médicale.*)]

Lactation lessens the duration and amount of the lochia. Some women have them for a few hours only (Van-Swieten), and others have none at all (Millot). An instance of the latter kind came under my notice quite recently (1855), in the case of the young wife of a medical friend. After an easy and happy labor, the lochia were almost completely suppressed. She hardly lost a few spoonfuls of blood within the first twenty-four hours; after the second day there was no discharge whatever, and the husband, who examined the linen daily with the greatest care, assured me that he was unable to detect the slightest evidence of lochial discharge. Everything went on well during the lying-in, with the exception of a very fetid odor from the genital parts during the first seven or eight days. After satisfying ourselves that there was no foreign substance in the uterus, we recommended the use of injections, frequently repeated, and all passed off well. This young lady had been delivered once before, on which occasion she had a perfectly regular lochial discharge.

In a case observed by Bruckmann, and quoted by Velpeau, the lochia were substituted by hæmatemesis.

In some instances, the sanguineous lochia are prolonged far beyond the usual term; while in others they reappear at various intervals, but this latter circumstance, in the absence of inflammation of the uterus or of its appendages, is ordinarily owing to some error in regimen, more especially to

getting up too soon; and, therefore, the best plan is to persuade the patient to remain in bed. In the course of a short time the lochia cease their continual flow, and intervals of several hours of duration are observed at first, then of a day, and sometimes of two days.

When, in spite of this precaution, the bloody discharge continues for two or three weeks after labor, its cause should be sought for in a local alteration of the uterus and of the neighboring parts, or else in the general condition of the patient. Thus, it is not unusual for it to be kept up by a circumscribed peritoneal inflammation, an inflammation of the uterine mucous membrane, a chronic or acute engorgement of one or both ovaries, or a phlegmon of the broad ligaments, of the iliac fossa, or of the cellular tissue surrounding the uterus.

It is important to diagnose these various affections from the outset, as it is they which should be attacked, in order to stop the discharge, which is here but a symptom of the disease.

The continuance of red discharges is connected, perhaps, more frequently with ulcerations of the neck of the uterus, having their origin in many cases in the lacerations which occur during labor, and the cicatrization of which is prevented by circumstances which elude our detection. When, therefore, it is certain that no symptom of engorgement or inflammation in the pelvic or hypogastric region is present, the patient should be examined with the speculum, taking care to separate the lips of the neck with the valves of the instrument, when very often a fungous and bleeding ulceration will be discovered either within the cavity of the neck or upon the os tincæ. The only means of arresting the discharge consist in cauterizations with nitrate of silver or acid nitrate of mercury, and even, if the fungosities are very projecting, with the actual cautery. In some cases, it is necessary to repeat the cauterization several times.

Amongst the causes of these anomalous lochial discharges, should be reckoned a local irritation sustained by obstinate constipation. Here the use of purgatives is demanded.

Sometimes no lesion can be discovered, but the discharge seems evidently to be connected with an over-excited condition of the entire organism. This condition is indicated by heat of the skin, fulness of pulse, some febrile movement towards evening, and disturbed sleep. Notwithstanding the apparent weakness of the patient, great care should be taken in reference to the use of tonics, which, unfortunately, are too often employed; a moderate antiphlogistic treatment, on the contrary, is the one indicated. A small bleeding from the arm, mild laxatives, and a restricted vegetable diet, might be directed with advantage. Stimulating or even tonic drinks should be proscribed, and only after the general irritation shall have been quieted, is it proper to endeavor to increase the strength of the patient by the appropriate means.

In some rare cases, however, the abundance and persistence of the bloody discharge seem to be sustained by the general debility. The absence of the general symptoms, just now mentioned, allow of recourse being had immediately to a tonic treatment; then it is that infusions of cinchona and sulphate of iron are capable of rendering effectual services. (See in Part Fifth the article devoted to *Secondary Hemorrhage.*)

The white or purulent lochial discharges sometimes become very profuse, and have at the same time an exceedingly disagreeable odor. The discharge is no longer covered with blood, but appears as a reddish water flowing in large quantity, and sometimes even escaping in gushes. They are occasionally so acrid as to inflame the parts over which they flow. The patients are almost always much weakened by the evacuation, and their general health evidently demands the use of tonics. The irritated parts should be washed frequently with warm water, and injections of infusion of chamomile flowers, afterwards made rather more astringent, should be thrown into the vagina five or six times a day. A few spoonfuls of chloride of soda might be added with advantage. [Carbolic acid ʒi. ad Oj. is at the present time most frequently used.]

These purulent lochia, also, sometimes continue long after the usual period of their cessation. This circumstance is sometimes connected with some one of the causes mentioned as productive of the anomalous persistence of the bloody discharge, though it has oftener seemed to me to be the result of a catarrhal metritis or peri-uterine phlegmon. Both these affections may hinder the gradual retraction of the uterus, which may remain of considerable size for a month or six weeks after delivery. Large flying blisters upon the abdomen, frequent alkaline baths, and bleeding from the arm, when there is fever and the strength permits it, have appeared to me to be the most effectual under these circumstances.

The suppression of the lochia long before the time at which they usually disappear is an unfortunate symptom only when it seems to be connected with the development of a serious inflammatory affection, or when it is replaced by a supplemental hemorrhage. It then merits the closest attention of the physician; but when the contrary is the case, there is no occasion for uneasiness, since it is the evidence of a rapid and forcible contraction of the uterus, which is a favorable circumstance.

§ 3. Of the Milk Fever.

One of the most important phenomena appertaining to the lying-in state, is that usually designated under the name of *the milk fever*. It has already been seen, when studying the modifications impressed on the whole organism by gestation, that the breasts in most women, even in the very commencement of their pregnancy, are apt to become tumefied, that the swelling persists, and that sometimes they become the seat of an abundant secretion long before delivery. After the delivery, they yield on suction a liquid of a yellowish color, and somewhat more consistent than the preceding, which in some women escapes during the latter months of gestation. This fluid has a sweetish taste, and is called the *colostrum*. It retains these qualities for twenty-four hours; but becomes whiter after that period. In the course of forty to sixty hours, the breasts enlarge greatly; the subcutaneous veins, seen through the skin, are more swollen than during the pregnant state, and the former become manifestly harder. The secretion of milk in healthy women is not usually attended with fever, the diminution of the pulse hardly being prevented by it (see page 422.) Still, if the swelling of the breasts be considerable, headache may occur, as also, at times, though more rarely,

slight shiverings, or heat and dryness of the skin, which is succeeded in a few hours by a copious perspiration; there are thirst and loss of appetite; the tongue is slightly furred; the pulse, at first small and contracted, soon becomes full, soft, and accelerated; and the face is flushed and animated. M. Pajot maintains that the pulse rarely rises above 100, which is generally true, though there are exceptions due to individual susceptibility. M. Béhier has noted the pulse at 130 in a case in which everything went on very favorably. During this febrile movement, which is generally slight, the enlargement of the mammæ continually increases, extends as far as the armpits, and involves the surrounding cellular tissue, whence the patient can no longer bring the arms down alongside of her body, and therefore has to hold them off. The skin is sometimes so stretched as to become painful and incommode the inspiratory movements of the chest; and lastly, as elsewhere stated, the discharge of the lochia either disappears altogether, or else is greatly diminished. This fever lasts for twelve, twenty-four, thirty-six, or possibly forty-eight hours, and then is followed by a calm; at times, however, it is continued for three or four days; but in such cases it is often due to a deep-seated inflammation, or else soon exhibits a well-marked intermittence, and may degenerate into a true intermittent fever, which yields readily to sulphate of quinine. The pulse is ordinarily not very rapid, and whenever it exceeds 100 per minute, the cause should be sought elsewhere than in the lacteal secretion.

Authors have stated that the milk fever is less intense with primiparæ than with others. The same is the case with those who begin to suckle their children very soon after delivery; indeed, it is not at all uncommon for the latter to escape it entirely. Finally, certain females, even of those who do not nurse at all, have no milk fever whatever, and this notwithstanding that the breasts are considerably swollen and the secretion of milk is abundant. This is a much more common occurrence than is generally supposed, and I have frequently had occasion to point it out to students. Still, I am far from supposing, as some do, that it forms the rule, and from regarding every febrile movement occurring in a lying-in woman, even when the lacteal secretion is commencing, as indicative of an apparent or concealed inflammation. Nothing, indeed, could be more reasonable than to regard the swelling and painfulness of the mammary glands as the cause of the general reaction which usually accompanies them, and which diminishes or ceases, as soon as the breasts become soft, or the system habituated to the new condition of things.

In some women the breasts remain inactive, and no milk it secreted; it really would seem, as Prof. P. Dubois has remarked, that nature has left her work unfinished in them; that, being capable of becoming mothers, and able during the whole term of gestation to furnish the necessary materials for the child's nutrition, yet their organization is absolutely inadequate to supply its wants after birth. I have at this moment under observation a young primiparous woman, convalescing, it is true, from an attack of varioloid which came on immediately after delivery, who has not had a single drop of milk.

The milk fever generally manifests itself about forty-eight hours subse-

quent to the delivery; at times a little sooner, at others somewhat later; thus, I have seen two patients at the Clinique (and all observers record similar facts), who had this fever, the one on the fifth and the other on the sixth day; and since that time I have often had occasion to make the same remark.

[For the sake of greater precision, we think it best to quote M. Béhier's observations on the subject. "I investigated," says this professor, "the cases of 974 women, in order to determine the precise period at which the flow of milk takes place. In 22 it occurred within the first day after delivery; in 170 on the second day; in 347 on the third day; in 266 on the fourth day; in 100 on the fifth day; in 22 on the sixth day; in 5 on the seventh day; in 4 on the eighth day; and in 1 not until the eleventh day."]

Where the child's death takes place at an advanced stage of gestation, and the dead body is not expelled for several days afterwards, it is by no means uncommon to find all the phenomena of milk fever manifesting themselves.

In ordinary cases, by the time the fever is over, the breasts have acquired their highest degree of distention, and the secretion of milk is very abundant. If the child draws well, they are emptied and the patient relieved; but should the mother not suckle her infant, the engorgement continues for a longer period, though it wears away the more promptly as it was less considerable in the first place, or as the milk flows more easily from the nipple, and as the perspiration and lochia are the more abundant.

The question as to the cause of milk fever has been discussed again and again; but without entering into all the arguments which this point of doctrine has given rise to, we will merely remark, that the febrile movement (which, however, is not always constant) most probably is a consequence of the greater activity the mammæ then assume, and that it is nothing more than what takes place whenever any organ undergoes a very considerable and rapid development.

To women who do not nurse, the lacteal secretion may be the cause of accidents which are to be prevented or opposed. Everything that could tend to increase the secretion of milk, such as succulent food, and the practice of drinking freely, should be strictly avoided. Warm and soft towels should be applied to the breasts, and renewed as soon as they become moist. A still better application is cotton wadding. By these means perspiration is excited, and the heat of the parts maintained. Should the secretion diminish gradually, everything may be left to nature, but should the breasts become too much swollen, the discharge from the nipple should be facilitated by the use of emollient cataplasms, or efforts be made to empty them by suction. In case of these measures proving ineffectual, recourse must be had to lotions containing laudanum for the purpose of relieving pain, and to sudorifics and purgatives as revulsives. As amongst the most commonly employed diaphoretics, we may mention weak tea, and the infusions of Parietaria and Borage. The purgatives are those which have been already mentioned. Of all the preparations which have been extolled as lactifuge, the *petit-lait* of Weiss[1] is, according to Desormeaux, the only one which is

[1] The *petit-lait* (whey) of Weiss is prepared by infusing in boiling whey a species of galium, flowers of elder, hypericum, and of the linden-tree, together with senna and sulphate of soda. It acts as a purgative.—*Translator.*

still employed. The same author states that he knew a lady to apply an ammoniacal liniment with success. Neuter asserts, as proved by experiment, that the application of cups to the back diminishes the flow of milk; and Van-Swieten knew a galactorrhœa to yield to a strong infusion of sage, taken in doses of from one to two ounces every three hours.

[M. Blot was the first to discover the presence of sugar in the urine of lying-in women as a phenomenon connected with lactation. It would seem from his researches that sugar, whose presence in urine had been regarded as pathognomonic of diabetes, exists not only in the urine of all lying-in women but in all nurses, and in a certain proportion of pregnant females. The term *Physiological glycosuria* has been used to express this fact.

"In all puerperal women (45 in 50)," says M. Blot, "the sugar begins to appear in the urine in determinate quantity coincident with the beginning of the flow of milk; and in many cases it does not exist until then. In a few cases it may be found previously, but generally in very small amount. If the secretion of milk continues, sugar continues to be passed in the urine with diurnal variations as yet unexplained. When the flow of milk is profuse, the proportion of sugar is usually large; if the former be moderate, the latter is small. In this way an examination of the urine may enable us to judge up to a certain point of the value of a nurse. If the flow of milk be lessened or arrested from any cause, and especially by the development of a more or less serious morbid condition, the sugar diminishes in quantity or disappears entirely. If health be restored and the secretion re-established, the sugar reappears. Finally, the urine contains sugar as long as milk continues to be secreted: I have found it in considerable proportion (8 grammes to 1000 of urine) in one case in which the woman had been nursing for twenty-two months. In fact, the urine is generally rich in sugar in proportion as the health improves and approaches most nearly to the normal or physiological condition.

"When lactation ceases, the sugar disappears, and that at periods varying in different individuals; earlier in those who do not nurse, and later in those who, having nursed, begin to wean the child.

"Sugar was found in one-half the observed cases of pregnancy. I think, without being able to affirm it positively, that this peculiarity is most likely to be observed when the breasts sympathize most with the pregnant condition; that on the contrary, it is absent when the breasts remain indifferent, as it were, to what is going on in the uterus." (Blot.)

This physiological glycosuria is also present in the different species of mammalia.

As a test of the presence of sugar in the urine, M. Blot used successively Fehling's fluid, caustic potash, fermentation, and the polarimeter.

Physiological glycosuria seemed then to be an established fact, when M. Leconte appeared with an absolute denial of the presence of sugar in the urine of nursing women, and asserting that the whole was a mistake due to the presence of uric acid, which gives reactions similar to those produced by sugar.

In this scientific dispute M. Bruecke espoused the cause of M. Blot, and, I would add, that a personal repetition of the experiments convinces me of the existence of physiological glycosuria. Further observations are, however, required in order to clear the subject of all doubt.]

CHAPTER X.

OF THE NECESSARY ATTENTIONS TO THE LYING-IN WOMAN.

THE patient should be placed in a large, well-aired chamber, which is moderately warm, and free from all strong odors. In summer, the doors and windows are to be opened every day; though, while the air of the apartment is being changed, she ought to be carefully covered, and have the curtains drawn, so as to protect her from any draft; but, at other times, the curtains need not be closed. The room ought to be kept scrupulously neat, and the urine, excrements, and soiled linen should be removed at once. The genital parts must be often bathed with lukewarm water, or some emollient decoction. These frequent ablutions have the further advantage of calming any inflammation in the parts that have been contused during the labor; they should be made morning and evening, and without uncovering the patient.

[As the newly delivered female is liable to various accidents, and diseases which make rapid progress, she ought to be visited every day.

In the first place, the physician should inquire into the general condition and determine the acceleration or lessened frequency of the pulse, which will rarely deceive as regards the prognosis. (See page 422.) He will also ascertain carefully the condition of the uterus as to size (see page 423) and sensibility, the character of the lochia, and the severity of the after-pains. The turgescence of the breasts and their secretion will also demand his attention; and, finally, he will inquire into the state of the bladder and rectum.]

The secretion and excretion of urine generally present nothing abnormal, though there is sometimes difficulty in the emission, due to swelling of the meatus. Occasionally, also, the bladder suffers temporary paralysis from severe pressure in tedious labors. In such cases the catheter should be used. The physician ought always, during the first two or three days, to inquire whether the water passes freely and with ease, because its collection in a half-paralyzed and benumbed bladder may often explain a state of uneasiness or suffering not otherwise to be accounted for.

[Retention of urine sometimes occurs with lying-in women immediately after delivery, and sometimes not until after several days. In the former case, it would seem due to paralysis of the bladder or contusion of its neck; in the latter, it is probably caused by consecutive inflammation. At other times the patients do not empty the bladder, and it remains considerably distended without their knowing it. Therefore, after questioning the patient on this subject, the accoucheur ought himself to ascertain whether the bladder is emptied. It is very important not to overlook a distended bladder, though it is often done, for then the physician necessarily falls into an error of diagnosis in regard to the cause of the suffering in the lower part of the abdomen.

The symptoms of retention of urine in lying-in women have some peculiarities. The bladder, being pressed forward by the uterus, which forms a resisting plane behind it, almost always projects sufficiently above the pubis to form a tumor there which is appreciable to the eye. The tumor is rounded, soft and supple to the touch, fluctuating, and dull on percussion. All these characters have but a secondary value, so that whenever retention of urine is suspected, the uterus should

first be sought for, and will be known by its size and especially by its hardness: if the uterus cannot be felt, it is because it is concealed by the distended bladder. Repletion of the bladder has, also, upon the position of the womb an effect which should be well understood: when the distended organ rises into the lower part of the abdomen, it carries with it the uterus, whose fundus is then found as high as, and often even above, the umbilicus, and when the catheter is used, it descends as the water flows. Whenever, therefore, the fundus of the uterus is found too high up, the sub-pubic region should be examined carefully to ascertain whether the bladder projects there. If the latter be empty, the fingers will, without difficulty, feel the anterior surface of the womb throughout.

Retention of urine sometimes continues in these cases for several days, and even for several weeks. So long as it lasts, the catheter should be used at least twice a day according to the rules already pointed out (see page 61). The bladder almost always recovers its power after a certain time, so that there is no occasion for alarm should the retention last for several days.]

The constipation that is so common during the last stages of gestation, oftentimes still persists after the delivery for four, six, or even eight days; and this prolonged retention of the fecal matters may give rise to anxiety, headache, loss of sleep, and sometimes even to a feeling of weight, or actual pain in one of the iliac fossæ; all which symptoms disappear like magic upon the administration of some mild laxative. Where the costiveness continues, a state of suffering very frequently results, which may occasion a slight febrile movement; and the frequency of pulse, thus produced, coinciding with the pain caused by an unusual retention of the fecal matters, which pain is most commonly located in some part of the hypogastric region, and is augmented by pressure, may give rise to suspicions of a peritoneal inflammation that really does not exist; and I have known this error to be committed where the pain and fever that had resisted the application of leeches, rapidly disappeared after the exhibition of a purgative. The retention of the fæces may also result from a paralysis of the rectum, which paralysis itself is a consequence of the pressure made upon it by the head during its prolonged sojourn in the excavation. I have known, says M. Martin, of Lyons, the fæces to be retained more than twenty days after a laborious delivery, and to accumulate in such large quantities, and acquire such a firm consistence as to equal the size of a child's head at term; and as all the usual laxatives failed, I was obliged to introduce a scoop, and bring the hardened matters away piecemeal; but even then the gut did not at once regain its functions, though a fresh accumulation was prevented by the use of irritant injections, and the contractility of the intestine was not perfectly re-established until twenty-nine days afterwards, at which period the patient left the hospital. (*Comptes Rendus*, p. 32.)

A temporary constipation, prior to the invasion of the milk fever, is a matter of no consequence; but should it persist for several days afterwards, injections may be administered, either simple, or else rendered slightly laxative by the addition of an ounce or an ounce and a half of the *miel mercuriale*, or a decoction of senna leaves; and where these measures do not answer, a mild purgative, such as the following, is exhibited by the mouth, viz., from half an ounce to an ounce of castor oil, rubbed up with an ounce of almond emulsion and a little lemon syrup. The compound licorice powder

of the pharmacopœia is a very efficient and pleasant laxative, and, although recommended especially for the constipation of pregnancy, will be found to answer the same indications after labor. Many patients suffer from hemorrhoids during convalescence, and in these cases half-grain doses of aloes, administered night and morning, have been recommended by Fordyce Barker as a specific.

The woman should make no exertion during the first few days, and if the labor has been long and painful, or attended with any serious accident, it is best that she should be protected from violent and rude motions, and that the bed be not made up until after the milk fever has subsided. When, however, the patients are but slightly fatigued, the bed may be made on the evening of the day preceding that on which the milk fever supervenes, after which it should be left until the next day but one; thereafter it may be made every day. The woman should, on these occasions, be transferred to another couch.

It is very important that the patient should not rise before the ninth day, which is a favorite time for getting up with the working classes, and where she is in easy circumstances, and can, without detriment to her interests, abstain for a longer period from her household duties, she should be required to remain in bed for at least two weeks. It were better not to adopt arbitrarily any particular day, but to regulate the conduct to be followed by the degree of atrophy of the uterus. When the latter has lost the greater part of its bulk, and its fundus descends and disappears in the lesser pelvis, the patient may get up. One woman may do so without danger on the eighth day, whilst another ought to remain in bed after the fifteenth day. At this period she may be carried to an easy-chair, where she will remain seated for an hour or two, and again, on the following day, for two or three hours. On the third, she might try her strength by taking a few turns around the chamber, and then through the apartments; but it would be imprudent to venture out of doors, especially in the winter season, before the fifteenth or twentieth day, and only then in fine weather and about the middle of the day.

Most women, actuated by a religious feeling, go to church on the occasion of their first going out; and as these buildings are always cold and damp, they often return with the germs of an inflammatory disease, which sooner or later develops itself; and hence the physician should advise the deferring of this religious ceremony, called the *churching*, to a more distant period.

As regards her diet, the articles ought to be of the mildest character, and of easy digestion; thus, as a general rule, she will only need, during the first day or two, a little porridge two or three times in the course of the day, and some broth during the night; and she should observe an absolute diet pending the duration of the milk fever, for fear of adding to its intensity; though even here, if the general reaction is moderate, she might be allowed some broth. After the fever is over, the quantity of nourishment is gradually augmented; so that, by the twelfth or the fifteenth day, the woman has resumed her ordinary habits. In those who do not nurse, the regimen must be more restricted, especially when the breasts still remain engorged or painful.

[The regimen of lying-in women, as just indicated, was rigorously observed until within a few years; but, we ought to add, there is now a strong disposition to act

differently. Legroux, physician at the Hotel Dieu, introduced the innovation by showing that not only was there no danger, but often a real advantage in giving nourishment freely to newly delivered patients. Accordingly, he allows soups to the women in his wards on the first day, and solid food on the second day after delivery. I have followed his example for several years, and have had no reason to be other than pleased with it. Immediately after delivery, therefore, I allow soup, taken in small quantities, but freely. On the next day solid food is permitted; an egg or mutton chop, for example, with bread and claret and water. After the secretion of milk has begun, the patients can resume their usual diet. This plan has but the single inconvenience of eliciting the disapproval of those who have grown up in other ways of doing; but inasmuch as it is better for the patients, we shall have to disregard these objections.]

Throughout the whole lying-in period, the patient should use some diluted ptisan, moderately sweetened and rendered aromatic, as an ordinary drink; such as a solution of gum, or an infusion of mallows, of violets or linden, the orange or chamomile flowers, &c., &c.; but acidulated drinks must never be allowed to those who nurse. About the seventh or eighth day, most patients ask their medical attendant for something to *drive away the milk*, which, of course, is generally a useless precaution; but, perhaps, it would be better to yield to a very popular prejudice, so as to escape all subsequent reproach. The Canne de Provence, and the infusion of periwinkle, &c., enjoy a high reputation for this purpose; and as the root of the former is nearly inert, it will, on that account, be preferably employed.

Most women think it necessary to be purged towards the end of their lying-in; and though, when the physician discovers any positive counter-indication to the administration of even a mild purgative, he doubtless should not yield to their desires; yet, under ordinary circumstances, he ought to purge them slightly, both on account of his own reputation and to avoid subsequent unjust reproaches; indeed, this will become necessary, if the tongue is broad, furred, and yellowish or greenish, the mouth bitter and clammy, and there is a loss of appetite. The Seidlitz waters and castor-oil are perhaps preferable, from their mildness and certainty of operation.

The excitability of the nervous system is such, in lying-in women, that the greatest care should be exercised in keeping away everything that might excite them, and in avoiding all acute moral emotions.

PART IV.

PATHOLOGY OF PREGNANCY.

THE pathology of pregnancy comprises all functional derangements occurring in pregnant women, as well as all spontaneous or accidental lesions of the ovum which may compromise the health or life of the fœtus. As the latter class usually either escape detection, or are not discovered until it is too late to remedy them, they will be considered briefly; all, in fact, that can be said of them is limited to certain questions of pathological anatomy, foreign to the main object of this work.

[Some of the numerous diseases observed during pregnancy are the result of this condition; others occur, as it were, by chance, and often happen under other circumstances. On this account, they are treated of in separate chapters; a division, however, which is far from perfect, as the distinction between the two classes cannot always be defined. The first chapter is devoted to the diseases which may occur during pregnancy, and the second to those which are the result of it. Afterward are described extra-uterine pregnancies, lesions of the ovum and of the placenta, and diseases of the fœtus and its death. The last chapter treats of abortion.]

CHAPTER I.

OF THE DISEASES WHICH MAY EXIST DURING PREGNANCY, AND OF THE RECIPROCAL INFLUENCE WHICH THEY MAY HAVE UPON THEIR PROGRESS AND TERMINATION.

THOUGH, says Antoine Petit, pregnancy exposes women to various disorders, it also protects them from many very dangerous diseases, arrests the progress of others, and sometimes even cures those with which they were previously affected. This proposition, though asserted almost as a maxim by the author quoted, is, unfortunately, far from being strictly true. Antoine Petit was indeed strangely deceived in his appreciation of the influence of pregnancy upon acute diseases existing before it or occurring during its progress; still, as many physicians partake of his error, we have thought it right to notice it at the outset.

§ 1. EPIDEMIC DISEASES.

1. *Influenza.*—Though some epidemics have appeared to spare pregnant women, many have affected them as severely, at least, as other individuals exposed to the same influences. Thus I found, as did also M. Jacquemier,

at the Maternity Hospital, that the epidemic of influenza attacked a great many pregnant women; but, contrary to his observation, I witnessed numerous abortions as a consequence either of the disease itself, or of the violent spells of coughing which tormented the patients.

2. *Cholera.*—The severe epidemics of cholera which, in 1832 and 1849, were so fatal in the capital, did not spare pregnant women; and we had the pain of witnessing the death of quite a number.

Dr. Bouchut has endeavored, in a quite recent work, to appreciate the effect of pregnancy upon cholera, and *vice versa.* Relying upon 52 observations, he commences by showing that pregnancy has no influence upon the invasion of cholera, that it protects from it no more than it predisposes to it, and that when the disease appears, it does so without any modification, in all its forms and severity.

Cholera has, however, an incontestable influence upon the course of gestation, often shortening its duration. Thus, 25 women out of 52 aborted in consequence of the disease, and the same would probably have been the case with others, had not the patients been removed by an early death. Except in some rare instances, abortion took place only in cases in which the disease lasted over twenty-four hours.

Of the 25 women who aborted, 16 recovered; 12 had the disease with moderate severity, though lasting for a considerable time; the attack in 4 was dangerous and rapid, and 9 died.

The observations of M. Bouchut have elicited the remarkable fact that abortion is very common in cholera patients after the fifth month of pregnancy, but very rare at its commencement. Thus, of the 16 women who aborted and recovered, only 1 was three months pregnant, 1 four, 6 five, and 1 six; and the least advanced of the 9 who died after abortion, had reached four months and a half.

Of the 27 women who did not miscarry, only six recovered and had their pregnancies to continue. The attacks which they suffered were of medium severity, and of several days' duration: 21 died with the disease in a dangerous and rapid form.

Altogether there were 30 deaths out of 52 cases. We see, therefore, that the prognosis of cholera is not rendered more favorable by the state of pregnancy.

We have said that 6 of the patients recovered, and had their pregnancies to pursue their regular course. Others, who had reached a more advanced stage, were delivered prematurely of living children. From this, it plainly results that cholera is not always communicated to the fœtus, and that though the latter usually succumbs either before its expulsion, or before the mother, in those cases where her early decease did not allow the abortion to take place, its death cannot be attributed to a transmission of the disease. Besides, the autopsy of the children revealed nothing which could be regarded as pertaining to cholera.

What, then, is the cause of the death of the fœtus, preceding, as it almost always does, its own expulsion, or the death of the mother?

M. Bouchut thinks that it is a consequence either of a mechanical compression of the uterus produced by the cramps and convulsions of the ab-

dominal muscles, or to the severe diet to which the patients are subjected again, he supposes that it may be occasioned by the profuse discharges from the bowels, which, by depriving the blood of its serum, dry up, as it were, the sources of nutrition. For my own part, I regard asphyxia as the only, or at least the usual, cause of the death of the fœtus. The coagulation of the blood, and its stagnation in the vessels, are evidently calculated to suspend the utero-placental circulation; and the interruption of the latter, depriving the fœtus as it does of the means of respiration, must necessarily lead to its rapid death.

M. Devilliers, Jr., read before the Academy of Medicine an observation tending to prove that abortion has a favorable effect upon the termination of cholera, and causing him to feel justified in recommending the provocation of premature labor, as a means of diminishing the danger of the disease. In examining under this point of view the results furnished by M. Bouchut, a result favorable to the opinion of M. Devilliers is at once discoverable; since of the 27 patients who did not miscarry, 21 died, whilst 9 deaths only occurred after 25 abortions. Still, it should be observed, that of the women who recovered after aborting, 4 only had the disease in a rapid and dangerous form; whilst of the 21 who died undelivered, the disease was very severe, and barely lasted a few days. This early fatal termination was, very probably, the only cause which prevented abortion.

The view of M. Devilliers cannot, therefore, be received without new confirmatory observations.

In short, though pregnancy does not affect sensibly the progress and danger of cholera, the latter leads, in the great majority of cases, to the death or premature expulsion of the fœtus.

§ 2. Endemic Diseases.

Intermittent Fever.—There can be no doubt that, as M. Ebrard has endeavored to prove, the grave disorders and deep perturbations produced throughout the economy by the febrile paroxysms, the obstinate vomitings which attended many of them, and the cough, diarrhœa, and colics, may disturb greatly the functions of the womb; also that the fluxion and congestion so often produced by this fever, may cause the premature expulsion of the product of conception.

The possibility of the occurrence being incontestable, the indication to remove the morbid condition follows as a matter of course. I mention this influence of intermittent fever upon the pregnant condition only as affording an opportunity of discarding completely the advice of some persons who recommend the rejection of sulphate of quinine, as likely to produce abortion or premature labor. The miscarriages laid to the charge of the sulphate of quinine should certainly be attributed to the disease itself, and not to the remedy. For my own part, I have had occasion to use it six times at various periods of pregnancy, in doses of ten, twelve, and even fifteen grains in the twenty-four hours, without having had to repent of it. Many practitioners, who, like MM. Thezet, Delmaz, Alamo, and Ebrard, have long practised in localities where this fever is endemic, have never been obliged to complain of the action of sulphate of quinine when administered

during pregnancy. Not only is it an innocent remedy, but the surest preventive means when abortion is imminent in consequence of the fever.

[Some facts go to prove that pregnant women attacked with intermittent fever may communicate the disease to the fœtus. Dr. Stokes, of Dublin, states, that he saw a case of tertian ague during pregnancy in which the fœtus was affected with convulsive movements remarkable for their correspondence with the apyretic days of the mother.

M. Pitre-Aubanais relates two cases of intermittent fever communicated to the fœtus by the mother. Both of these children were born with hypertrophied spleens, and their attacks of fever coincided both as to day and hour with those of the mother. (Bourgeois de Turcoing.)

M. Jacquemier also says, that it would seem that intermittent fever may attack both mother and fœtus at the same time, and the facts upon which he bases his assertion, though few, appear conclusive. Schurig relates that a woman had a rebellious quartan ague in the second month of her third pregnancy, and that in the last month either before or after the paroxysms she felt the child to be excited, shiver, and roll perceptibly from one side to the other. At last, after a severe paroxysm, she was delivered of a girl which had a violent attack of fever at the same hour with the mother, and which continued to return during seven weeks. Similar cases were observed by Hoffman and Russell. (Jacquemier, *Traité d'Obstetrique.*)]

§ 3. Eruptive Fevers.

1. *Variola.*—The *eruptive fevers* seem, generally, to be much more dangerous to pregnant women than to other individuals. Variola, especially, of all these diseases, has the most disastrous influence upon the pregnant condition; some authors, indeed, state that it is almost uniformly fatal, particularly when it produces abortion.

It is important, as regards the prognosis, to distinguish between the confluent and discrete forms of small-pox. (Chaigneau.) The former, which is so fatal, independent of pregnancy, as to destroy a third of whom it attacks, is still more to be dreaded during gestation, sparing, as it does, almost none of its victims; the latter, on the contrary, is far from always occasioning abortion or premature labor, and even where the pregnancy is ended before term, the mother often recovers.

Dr. Gariel thinks that the lumbar pains, which are so severe in the first stage of variola, have a great tendency to produce abortion. I have seen in two cases of the discrete form, slight contractions coinciding with these lumbar pains; but I was able to arrest them by the use of opiate injections. In several other instances, I witnessed nothing of the kind, and I think with M. Chaigneau (Thesis, 1847), that abortion is specially liable to occur when the pustules are in full suppuration, and the secondary fever appears, in connection with the grave symptoms which usually accompany it.

To recapitulate: confluent small-pox nearly always occasions abortion, and this is almost uniformly followed by the death of the mother: out of 23 abortions observed by M. Serres under these circumstances, there were 22 deaths. Discrete small-pox, on the contrary, generally allows the pregnancy to continue its course, and even when it interrupts its progress, the mother usually recovers, and in the latter months the child is expelled alive.

When the fœtus is not expelled, it may continue to grow, and often it does

not appear at birth to have suffered much from the disease which had endangered its mother's life so greatly; in other cases, however, either because it receives the germ of the disease which affects the mother, or because the deep-seated disorders which the variola produces in the maternal system also exert an unfavorable influence upon the fœtal life, it soon perishes. In the former case, variolous pustules, in every respect similar to those on the mother, may be detected on the body of the child.

[We have just stated that the unborn child of a mother affected with variola may contract the same disease, a fact attested by various authors. In this case, the mother communicates a contagious disease with which she is herself suffering; but it would be wrong to suppose that every pregnant woman having variola must necessarily transmit it to her child. M. Serres knew of twenty-two non-variolous children born of women who had the disease during pregnancy. Mead even holds that if the woman does not abort, her child is exempt from variola for the rest of its life, provided it be not born before the maturity of the eruption. The fact is curious, but denied by Contugno, whose opinion may find support in the following facts: Two pregnant women were inoculated; the eruption was discrete, and gestation progressed. At the usual period they were delivered of healthy children, which, at three years of age, were inoculated and had the regular disease.

On the other hand, it seems that the fœtus only may have variola before birth, even though the mother may never have had it. Though the fact may appear extraordinary, it cannot be questioned in opposition to the testimony of such credible authors as Ebel, Kesler, Watron, Jenner, Deneux, Royer, Bouchut, and Chaigneau, all of whom have seen children born with variola, the mothers being free from the disease. In several of these cases, the mothers having been vaccinated were insusceptible to the epidemic influence, yet were able to communicate the virus to the fœtus.

Congenital variola appears at all stages of pregnancy. Before the third month it is rare; and generally it is discrete, so that there may not be at the utmost more than a hundred pustules on the entire body, and often many less. It is observed that the pustules do not follow the same course of evolution as they do in the open air, but being always bathed in the amniotic fluid present the same phenomena as those which affect the mucous membranes. They are whitish and flattened, but larger than such as are found in the cavity of the mouth. A few become resolved, but others ulcerate quickly when the slight pseudo-membranous disk covering them falls off. The wound suppurates little, never furnishes crusts on account of the moist state of the parts, and cicatrizes without leaving any mark. Occasionally, however, the characteristic scar is seen, but even then is very superficial.

When mother and fœtus have variola at the same time, the pustules appear at the same time in both. M. Chaigneau has, however, seen a few cases in which it was later in the children, not occurring until long after it had disappeared from the mother. The unborn child affected with variola is almost sure to die. (*Bourgeois de Tourcoing.*]

2. *Scarlatina*, when of some severity, acts in nearly the same way as variola; the danger, however, is usually far less both to mother and child. It sometimes gives rise to abortion, and then the patients very often succumb. My opinion coincides with that of M. Serres, who thinks that women are much more likely to contract the disease when recently delivered than they are during pregnancy, for I have never seen scarlatina during gestation, though I have had the misfortune to lose two newly-delivered females from the disease.

3. *Measles*, according to Levret, is quite as grave as the preceding. In four cases, however, observed by M. Grisolle, the regular course of gestation was undisturbed, and two similar instances have come under my own notice.

[Unfortunately, however, this is not always the case, for M. Bourgeois de Tourcoing, from whose excellent memoir we have made several extracts whilst preparing this chapter, has himself met with fifteen cases of rubeola in pregnant women, eight of whom either aborted or were delivered prematurely. In the remainder the pregnancy was not interfered with. In the former the disease was most severe in the most advanced cases, and the first symptoms of abortion or delivery appeared toward the end of the disease.

Very rarely have children been born affected with rubeola; Rosen and Vogel relate some cases; Guersant met with one, and Bourgeois mentions another, in which the child lived but three days.

§ 4. Various Sporadic Diseases.

1. *Typhoid Fever.*—Typhoid fever may occur at any stage of pregnancy. It often causes abortion, which may take place in the first or second week of the disease.

According to Bourgeois, of twenty-two cases attacked early in pregnancy, six who had the disease lightly did not abort, whilst out of sixteen grave cases twelve aborted. Of fifteen cases of fever occurring during and after the seventh month, the same observer notes nine cases of premature delivery. Of these, five occurred during the first week of the disease; five of the children were still born, one lived two days, and one survived.

The remaining women were delivered during the second week of the fever; two of the children died during labor; one lived two days and a half, and one only was raised, being an eight-month's child. The two surviving children presented nothing peculiar.]

Though I have rarely had occasion to observe typhoid fever during pregnancy, I have frequently seen it occur during the lying-in. Its commencement is usually insidious, the first symptoms having always been those of a puerperal inflammation, and presenting all the characters of the typhoid disease only after the lapse of the first few days, and the disappearance of the abdominal symptoms. What is very singular, if I may judge by the cases which I have observed, the typhoid fever, so far from being influenced unfavorably by the puerperal state, is even less grave than in the ordinary conditions of life. Not one case of 17, of typhoid fever supervening a few days after delivery, proved fatal. The same remark is made by M. Fauvel, who did not witness a single death in the cases of the lying-in women who had the disease. Although the cases are too few to warrant a definite conclusion from them, they seemed to me of sufficient interest to be recorded.

2. *Pneumonia* is, without doubt, of all the acute inflammations of the envelopes or of the parenchyma of the organs, one of the most likely to produce abortion or premature labor. M. Grisolle has himself observed 4 cases of pneumonia in pregnancy, and collected the details of 11 others. Of these 15 women, 10 had not reached the sixth month, and 4 aborted the fourth, fifth, sixth, and ninth days from the commencement of the attack. In 3 cases, the abortion was followed by disease of the lungs of the severest character, all proving fatal three or four days after; only one, whose pneumonia was limited, recovered without serious symptoms. The 6 who did not miscarry, died without exception during the progress of the disease.

Of the 5 women who had reached an advanced stage, 2 were seven months pregnant when attacked with pneumonia; one was delivered prematurely on the twelfth, and the other on the fifteenth day, both dying two days after. The 3 others were in their ninth month: 2 were delivered of living children on the seventh and eighth day of the disease; the other died undelivered on the fifth day.

From the preceding data it may be concluded, that abortion usually follows an attack of pneumonia during pregnancy. I think, says M. Grisolle, that its disastrous influence is explained by the importance of the organ affected, by the gravity of the disease, the intensity of the general reaction, and the numerous sympathetic disorders which it produces in all the functions, much rather than by the paroxysms of coughing.

That the pregnant condition exerts a most dangerous influence upon the disease is shown by the fact, that of 15 women 11 died, though the general state of health was apparently very favorable in most of them. The prognosis seems to be more discouraging before than after the seventh month. Finally, if it be allowable to conclude from so limited a number of facts, abortion, contrary to what we have seen in regard to variola, would appear to be rather favorable than otherwise, since of the 4 cases of miscarriage one recovered, whilst the 6 who did not abort, all died. This would seem to confirm the following proposition of Desormeaux, namely: Abortion, which occurs but too often in acute diseases, frequently leads to a favorable termination in inflammatory affections.

3. *Various Inflammatory Diseases.*—We have but very imperfect data by which to judge of the reciprocal influence of pregnancy and of other acute inflammations. The statements of authors in regard to it are limited to a few isolated and often contradictocy facts, whose very restricted number allows no useful conclusion to be drawn from them.

Whatever be the acute affection from which the pregnant female suffers, the treatment does not differ materially from that which is proper under ordinary circumstances. So long as there remains a reasonable hope of saving the mother by the use of mild and innocent remedies, none other should be resorted to; but if the disease be dangerous, and demands more active but more efficient means, it should be treated as though the woman were not pregnant. Bleeding and purgation which have been reproached with a tendency to produce abortion, may doubtless have that effect; but it must not be forgotten that they are used here to combat an affection which is, of itself, a much more active cause of abortion, besides endangering the mother's life so seriously.

4. *Icterus.*—Though icterus appears to affect the pregnant condition unfavorably, it is not exactly true to say that it always arrests its progress and produces abortion, either as regards the severest or the lightest cases of the affection. I have seen several cases of simple jaundice which constituted but a slight indisposition, and in no degree affected the gestation. The contrary has, however, been the case in some instances, and the two following, quoted by M. Ozanam, seem to me to be evidently exceptional:

A young primiparous woman, five months gone, had been sick for five days with a very simple jaundice, when she entered the hospital; three days

after, she miscarried. Another, seven months and a half pregnant, also aborted five days after the commencement of a simple icterus. Neither of the children presented a yellow hue. Both mothers recovered.

The life of the child is greatly endangered by its premature expulsion, though it is rarely affected with the mother's disease. In none of the cases which have come under my notice did the fœtus present an icteric hue, although the amniotic fluid was more or less colored. J. P. Frank, however, relates the case of an icteric female who was delivered of a jaundiced child.

It is rarely that what is described as the grave form of essential icterus does not determine abortion, and it is also rare for the latter not to be followed by the death of the mother. Thus, out of the five cases reported by Dr. Kerksig, in the account of the epidemic which occurred in 1794, there were four deaths. M. Ozanam relates the case of a woman six months pregnant who died before miscarrying; and my friend, Dr. Fournier, has quite recently had a case of abortion followed by death.

[Churchill quotes the following account by Dr. Saint-Vel of an epidemic of jaundice in the island of Martinique in 1858.

"This icterus, which presented all the characters of an essential disease, surprised the medical men by its epidemic character, and its gravity in pregnant women, and in them only. It began at Saint-Pierre about the middle of April, reached its height in June and July, and having gone through the colony, ended with some isolated cases toward the close of the year.

"Attacking the various races of which the population consists, the white as well as the negro and the Indian coolie, the European as well as the Creole, it seemed to prefer adults, and was unattended with affection of the liver. When pregnancy did not exist, its termination was almost invariably favorable. The only victims were women, amongst whom were three young females not pregnant, and a woman of sixty-three years of age. In these it was always of a grave character, always the same, always mortal, and always accompanied by coma.

"Of thirty pregnant women attacked at Saint-Pierre, only ten reached term with no other symptoms than those of essential icterus. The remaining twenty died comatose after abortion or premature delivery.

"In the gravest cases in pregnant women the disease always pursued the same course. It always had the essential form, and was often light, until the occurrence of abortion or premature delivery, which never took place before the jaundice appeared. They were generally brought about by the latter after it had existed for two, or, less frequently, three weeks. Until coma appeared, the symptoms had no apparent gravity, nor presented anything peculiar. The coma preceded or followed the abortion or labor by a few hours, in two cases only coming on three days after.

"The women who died had reached the fourth, fifth, sixth, seventh, and eighth months of gestation. The coma was, in rare cases, preceded by a slight delirium, it never for a moment disappeared, but grew more and more profound until death occurred. It lasted but for a few hours, though in two cases it continued for twenty-four and thirty-six hours. Until it came on there was nothing special to be observed in regard to the general sensibility, respiration, or circulation. The pulse was not quickened, nor had it that slowness which is sometimes observed in cases of jaundice. None of the other features of grave attacks of icterus, not even uterine hemorrhage, were observed. With perhaps one exception, the women who died had no hemorrhage after delivery, and when death occurred, three or four days subsequently, the lochia were of a normal character.

"Almost all the children were still-born, a few only living for a few hours, whilst but one survived and is still living. None of them were jaundiced, nor had any of the ten other children born at term of jaundiced mothers any sign of the disease." (Saint-Vel, *Gazette des Hopitaux*, Nov. 20th, 1862.)

On the other hand, Dr. Bardinet read in 1863 an account of a grave epidemic of icterus which prevailed in Limoges from the month of October, 1859, to March, 1860. In 13 women observed by him the pregnancy followed its regular course in five cases which were delivered safely at the ninth month. In 5 others the disease was followed either by abortion or premature labor. In the remaining 3 the icterus assumed a grave form with ataxic symptoms followed by coma, and both mothers and children soon perished.

Both multiparæ and primiparæ were attacked by the disease, but all had passed the fifth month of gestation.[1]

Dr. Bardinet recapitulates as follows:

1. Icterus may appear as an epidemic amongst pregnant women.

2. It then assumes three different forms, viz.:

a. In the first it is simple or benign in character, and allows the pregnancy to progress favorably to term.

b. In the second it assumes the first degree of malignity, forming what might be called *abortive jaundice*, and occasioning either abortion or premature delivery without other unfavorable consequences.

c. In the third it assumes all the characters of the grave form of icterus, producing ataxic symptoms and coma, which soon terminate the lives of both mother and child.

H. Blot, in the excellent report from which I have quoted the preceding facts, relates a severe case of icterus observed by him at the Hospital of the Clinique. The patient died, and at the autopsy ecchymoses were found beneath the skin, and on the surface of the brain, of the heart, of the lungs, and of the intestinal canal. The liver was small, and of a deep-brown color, without yellowish spots. Microscopic examination showed that the tissue of the latter organ was destitute of a single trace of an hepatic cell. All the preparations showed merely fat globules in abundance mixed with biliary matter.

The cause of grave icterus during pregnancy remains unknown. I am disposed, however, to believe with M. Blot that it is due to changes in the liver, which I described long ago as occurring in pregnant women. (See p. 157.)

In regard to treatment, we are obliged to admit the inefficiency of all measures employed up to the present time. Premature labor or abortion would probably be more injurious than useful. As to prophylaxis, we should not hesitate in case of the occurrence of epidemic jaundice, to advise pregnant women to change their place of residence.]

5. *Syphilis.*—Syphilis may have the most disastrous effect upon the course of gestation, being a very frequent cause of abortion, and especially of premature labor. Its mode of action is various: sometimes, for example, the mother is in such a cachectic condition as to be unable to provide the fœtus with the material required for its development, her enfeebled constitution leaving the work incomplete; most generally, however, the health of the mother is not sensibly altered, and the action of the poison seems to be directed upon the fœtus only. In most cases, indeed, the disease does not disturb the natural course of gestation, but attacks gravely the health of the fœtus. Nothing is more common than for the latter to perish at more or less advanced periods, and be expelled prematurely. In these instances, numerous visceral lesions are discovered at the autopsy: sometimes it is an

[1] H. Blot, *Bulletin de l'Académie de Médecine*, October, 1864.

abscess of the thymus gland (P. Dubois); sometimes purulent collections in the lungs (Depaul); sometimes, again, is found that singular alteration of the liver so well described of late by M. Gubler, or those traces of peritoneal inflammation and sero-purulent effusions pointed out by Dr. Simpson as due to the same cause. Neither is it rare to find numerous bullæ of pemphigus upon various parts of the body of the child, especially upon the soles of the feet and the palms of the hands. For further details, see *Diseases of the Fœtus.*

Cases such as we have just mentioned are, unfortunately, but too common; it is not, however, to be understood that every child born of infected parents must necessarily suffer all the consequences. We even insist that such is not the most frequent result, for considering the large number of parents who are diseased, or who have been, the syphilitic lesions of new-born children would be much more frequent than is really the case.

M. Legendre, in discussing the question of the latent condition of syphilis in the parents, and of its influence upon the health of the child, arrives at a denial of this influence in the majority of cases.

Of the 63 patients who came under my observation, he says, there were 14, who had altogether 68 children, during the period intervening between the disappearance of the primary symptoms and the development of the venereal eruption. Of this number, 35 died without ever having had an eruption upon the body. The mean of the ages of these children at death was 7 years; the extremes being 6 months and 22 years.

All the 33 surviving children enjoyed good health, the mean of their ages being 17 years; the extremes 1 year and 38 years.

[Inasmuch as it is said that syphilis may be transmitted by either parent, it is far more probable that it should be when both are diseased. We will examine successively the first two conditions.

A. *Transmission by the father.*—The father only being syphilitic, can he communicate his disease to the child? The question is, at present, much disputed, for although the affirmative is maintained by Trousseau, Diday, Depaul, and Bourgeois, a directly opposite opinion is arrived at by Cullerier, who bases his view upon the observation of healthy children whose fathers were syphilitic, but whose mothers were not. He believes that inherited syphilis is always derived from the mother, the father having nothing to do with it. The same doctrine is taught in the memoirs of Notta and Charrier, and our colleague M. Follin (*Traité de Pathologie Externe*) has observed six cases favorable thereto.

It is not easy, therefore, to decide the question. For our own part, we think that although the transmission of syphilis from the father to the child can hardly be denied in some cases at least, it is certainly less common than has been supposed.

B. *Transmission by the mother.*—This cannot be doubted. Two cases, however, present themselves: the mother may be syphilitic from the period of conception, or she may not have contracted the disease until after she became pregnant. In the first case there is no dispute as regards the fact of infection, but the unanimity ceases in the second case, when the question arises at what period of gestation the mother must be infected in order that it should be possible for her to transmit the disease to the fœtus. Cullerier thinks that it may occur at any time during pregnancy, whilst Ricord would restrict the possibility to the end of the sixth month, and Abernethy the seventh.

The opinion which would attribute to the use of mercury the effect due to the

action of syphilis, is both false and dangerous. The observations of M. Dunal have shown that syphilitic women who had never been treated, or if so, in an imperfect manner, either aborted or were delivered prematurely of still-born or infected children which died: with those, however, who had the constitutional disease and were treated by mercury, the success was complete in many instances in respect both to mother and child.

6. *Saturnine intoxication.*—Women exposed to lead poisoning are very liable to abort. A former hospital interne, Dr. Constantine Paul (*Archives Générales de Médecine*, May, 1860), made a study of the effects of this action during gestation. He observed, in 1859, the case of a woman who had been three times safely delivered before being exposed to the influence of lead, and who afterward, out of ten pregnancies, had eight miscarriages, one child still-born, and but one delivered at term, but which died five months afterward. Struck by the observation, M. Paul thought that this great mortality might be due to the action of lead. The woman also informed him that almost all her companions in the establishment in which she worked either miscarried or were unable to raise their children. Then it was that he began his investigations.

M. Paul found 81 cases of women in whom saturnine intoxication occasioned either the death of the fœtus or the premature death of the child after birth; also miscarriages at from 3 to 6 months, and premature labors in which the children were born either dead or in a dying condition.

Out of a first series of observations, 4 women afforded a total of 15 pregnancies, in which there were 10 abortions, 2 premature labors, 1 still-born child, 1 which died within twenty-four hours, and 1 only which survived.

A second set of cases comprises the history of women who had been safely delivered before exposure to the influence of lead, but whose children afterward suffered from its effects.

Another set shows the alteration of results according as the woman gave up or resumed her occupation on several different occasions.

A final series proves that the fœtus may die of lead poisoning, even though the mother may have had no symptom of the intoxication.

To recapitulate. Out of 123 pregnancies there were 64 abortions, 4 premature labors, 5 still-born children, 20 which died within the first year, 8 in the second, 7 in the third, and 1 death at a later period, 14 living children, of whom 10 only were more than three years old.]

7. *Phthisis.*—Most authors, in writing upon this disease, have given currency to the idea, that its progress is arrested by the occurrence of pregnancy, but that immediately after delivery, the pulmonary affection advanced rapidly to a fatal termination.

In a work read lately before the Academy of Medicine, M. Grisolle has endeavored to determine the reciprocal influence of these two conditions, and in so doing has arrived at somewhat different conclusions from those which had been received as a general expression of the truth. We think it right to give a brief analysis of this memoir.

Of seventeen cases collected by M. Grisolle, and ten others furnished him by M. Louis, twenty-four were those of women attacked with the disease during pregnancy, at periods not far removed from its commencement; the three others had reference to individuals who presented the rational signs of tuberculosis at the time of conception, but in whom the disease became well-marked only at a later period.

In none of these cases was the pulmonary affection arrested, nor did it

fail to progress quite rapidly. The symptoms peculiar to tuberculosis, whether local or general, were developed with the same order, the same regularity, and the same constancy as in the ordinary conditions of life. But, on the other hand, contrary to what might have been expected, the pregnant condition neither aggravated, nor rendered more frequent, the accidents of the disease; bronchial hemorrhage was noticed as being even rather less frequent than usual.

The entire duration of the phthisis in 13 women who were followed to the end was rather shortened than otherwise. Thus, in all of them it lasted on an average nine months and a half, which is a figure more than a third less than that which expresses its duration for women of the same age, but not pregnant.

Pregnancy has not, therefore, the power of suspending phthisis, which has been supposed. But is it true, as is generally believed, that labor, and the puerperal condition, give to the process of tuberculization such an unusual impulse as to make it prove fatal in a very short time? The facts appealed to by M. Grisolle invalidate this opinion also. Thus, 12 women, in whom the disease had reached the second, and in most of them the third degree, at the time of delivery, resisted its inroads for four months on an average; and in all, the symptoms followed the progression that is usually observed. In 10 others, in whom the affection was in the first degree, or at the beginning of the second, at the period of delivery, the pulmonary lesion was found in 3 to advance slowly; in two only did it exhibit a notable aggravation; whilst in 5, or one-half the number, there was a considerable amelioration both of the general health and local symptoms, without, however, encouraging the hope of a cure, or of a long suspension of the disease.

Does phthisis exert an unfavorable influence upon the progress of gestation? In this point of view, it may at least be regarded as much less serious than pneumonia. Thus, of 22 women, only 3 aborted in the fourth and sixth months, 3 were delivered prematurely about the eighth month, whilst all the others reached their full time; however, in nearly two-thirds of the latter, the pulmonary disease commenced in the early months of gestation, passed through all its phases, and produced a deep-seated cachexia.

With one exception, delivery was accomplished after four or five hours of suffering, which is explained rather by the relaxation and want of resistance of the soft parts, than by the small size of the children. Although the latter were generally feeble and emaciated, yet in more than a quarter of the number the tissues were firm, the form rounded, and of an embonpoint contrasting remarkably with the reduced condition of the mother.

In all the patients, except those who were in the last stages of consumption, and who died a few days or weeks after delivery, milk was secreted, and in the majority of cases so abundantly, that it was impossible to prevent them from nursing the children.

The flow of milk, however, lessened, or even ceased, within a period varying from one to four weeks; and even this short-lived lactation was always accompanied by a sensible aggravation of the disease, and had the most disastrous effects upon the children; for they died shortly after of softening of the intestinal mucous membrane.

From a very interesting memoir upon the same subject, by M. Dubrueilh, of Bordeaux, it appears that the result of his observations has been nearly the same.

In short, neither pregnancy nor delivery affect the progress of phthisis nor does the latter disturb sensibly the course of the former.

8. *Hysteria; Epilepsy; Chlorosis.*—Some physicians have imagined that the occurrence of pregnancy might exert a favorable influence upon hysteria or epilepsy, either by suspending the attacks during the continuance of gestation, or even by ridding the patients of these affections entirely. Unfortunately these hopes have not been realized by experience; for although the convulsive attacks have seemed in some cases to be less frequent, or have even ceased entirely, in others, they have occurred much oftener than before. M. Malgaigne mentions a remarkable case in which the first epileptic attack came on during pregnancy in an unfortunate female who had never before been affected with it, and who retained it throughout her future life.

Marriage, and the consequent pregnancy, have often been recommended as the best means of curing chlorosis. When this disease appears to have been produced by disappointed love, the cause may, indeed, be thus removed, and the remedies directed against it rendered more efficacious. Pregnancy may, in this way, regulate the uterine functions for the future, cure the dysmenorrhœa, and consequently have a favorable effect when the irregular or difficult menstruation was the cause of the chlorosis. Under all other circumstances, however, pregnancy has seemed to me to aggravate the chlorotic symptoms. I, therefore, think it most prudent to defer marriage until after the general health of the patient is improved.

§ 5. Surgical Diseases.

1. The pregnant condition often has a favorable effect upon scrofulous ulcers. Under the influence which it exerts upon the entire organism, glandular engorgements sometimes disappear, diseases of the bones are modified favorably, ulcers become clean and covered with bright, firm granulations, and cicatrization follows.

In many cases, it has appeared to arrest the consolidation of fractures. A curious instance of the kind is mentioned by Alanson. A woman broke her tibia when in the second month of her pregnancy, and during the seven succeeding months, the solidification made no progress. Nine weeks after delivery, the callus was strong enough to admit of walking. As proving that no constitutional depravation could be adduced in explanation of the retarded cure, he adds, that three months before impregnation, she had recovered rapidly from a fractured thigh. My friend, Dr. Fournier, cites three analogous cases from Dupuytren's Clinic. In all three, there was no consolidation before delivery, though it took place rapidly afterward. Though other similar instances are on record, it must be acknowledged that there is also a considerable number in which recovery did not seem to be delayed by the pregnant condition.

2. *Serious operations* have several times been performed during gestation without producing abortion, whilst in other cases they have had this result.

From these opposite facts, I think it fair to conclude that none but urgent operations should be performed, and that all others, such as fistula in ano, for example, which do not endanger the life of either mother or child, should be deferred to another time.

3. *Tumors in the Abdomen and Pelvis.*—Most authors think that tumors in the abdomen and pelvis during pregnancy, have no other effect than to impede mechanically the development of the uterus, or to present an obstacle to the delivery. (See *Dystocia.*) Sometimes, however, they assert, they may give rise to abortion or premature delivery, though, generally, they are not otherwise dangerous.

That this complication is of no danger, independent of the risk of abortion which it may occasion, cannot be admitted in an absolute sense. Dr. Ashwell has remarked, in his excellent work, that the uterus, when developed until term, exerts a strong compressing force upon the pathological tumor; that this compression may give rise to an inflammation ending sometimes in suppuration at the centre of the diseased mass, at others, in a rapid increase of the tumor immediately after delivery. I have several times had the opportunity of verifying the accuracy of these statements. Death may occur in a short time, as the consequence of this inflammation or rapid enlargement, and the autopsy has several times exhibited the uterus in a perfectly healthy state, together with the more or less extensive alteration of the pathological tumor.

Deeply impressed by the cases of this kind which he had occasion to observe, Dr. Ashwell asks, whether the development of the uterus, and the pressure which it exerts upon the neighboring tumor, are not the causes of the pathological changes of the latter, and consequently whether the induction of premature labor would not be the surest means of guarding against the dangers to which the female is so often exposed in these cases, even after having overcome all the difficulties of labor. When treating hereafter of premature labor, we shall have occasion to criticise the affirmative decision which he has come to; but we have thought it right to direct attention to a peculiarity but little known in the history of the tumors which complicate pregnancy.

4. *Intra-parietal fibrous tumors,* or those developed in the substance of the walls of the uterus, may exert an injurious influence upon the course of gestation, and become a cause of abortion when they are of large size; though, generally, they have no effect whatever when small. In the latter case, the physiological evolution of pregnancy may accelerate wonderfully the increase of the pathological tumor. The usually slow growth of these intra-parietal tumors is well known; now I have known them in several instances to acquire a size in the first three or four months, which they would not have done in several years in the non-pregnant condition. Developed as they are in the midst of the uterine fibres, they participate in the increased vitality with which the latter are endowed during gestation; and, like them, they undergo a considerable hypertrophy.

In some cases I have seen this hypertrophy of the morbid tumor continue, and even increase after delivery; but in others, the latter event was followed by a notable diminution of the size of the tumor, which gradually grew less

as the womb resumed its normal condition, finally attaining the size which it had before conception. In one case, observed in 1852, this process of absorption went on, and the tumor disappeared.

[§ 6. Hypertrophy of the Thyroid Gland.

It is by no means rare for the thyroid gland to undergo hypertrophy during gestation apart from any endemic influence. The enlargement is generally slight and gives no trouble, though some women complain that their necks become large and unsightly. The swelling diminishes somewhat after delivery, though it rarely disappears entirely.

I knew one case in which the hypertrophied gland inflamed and suppurated, giving rise to an abscess which discharged for a long time; nor was the cure complete until after the lapse of several months.

Although this hypertrophy of the thyroid gland in pregnant women is not usually dangerous, it may in some very rare cases imperil the life of the patient. Two instances of this kind are related by M. N. Guillot. The first was that of a lady who was surprised during her first pregnancy to find that the front of her neck was gradually enlarging. When again pregnant, the swelling increased and became uncomfortable; still, the delivery was favorable, and she nursed the child for fourteen months. The gland, however, continued to enlarge, respiration became painful, and finally the symptoms were so threatening that tracheotomy was performed. The patient died.

In the second case, the hypertrophy also appeared during the first pregnancy and increased during the succeeding one, so that nineteen months after the second delivery it formed a tumor of about eight inches in circumference.

The breathing was obstructed, slow, and whistling, during both expiration and inspiration, and the voice was broken and painful. Paroxysms of suffocation came on, during one of which the patient died. At the autopsy the trachea was found to be flattened and the pneumogastric nerves compressed.

I witnessed for myself a similar case at the hospital of the Clinique in 1861. A woman, who for a long time had a goitre, found the tumor to increase rapidly in size during her first pregnancy. At the sixth month, respiration had become very difficult, and attacks of suffocation brought her to the hospital. By the end of the eighth month the symptoms were so severe that premature labor had to be induced, but the patient died in an attack of suffocation a few hours after delivery. My friend Dr. Tillaux, then prosector of the Faculty, dissected the tumor and found the trachea compressed by the enlarged gland.]

§ 7. Ulcerations of the Neck of the Uterus.

It is rarely that cancerous affections of the neck of the womb seem to disturb the course of gestation, and the impediments which they but too often present during labor prove sufficiently that they are rarely a cause of miscarriage. On the other hand, I have never observed that the increase or degeneration of these tumors was sensibly hastened during gestation. Therefore, I shall treat no further here of this subject, reserving its discussion for the article on tedious labor; but propose to speak briefly of ulcerations of the neck during pregnancy.

It has been but a short time since surgeons have used the speculum in the cases of pregnant women. A just fear of the mischievous effect which might follow its repeated introduction prevented them from obtaining a correct idea of the condition of the neck at the various stages of pregnancy. These fears

were, however, somewhat exaggerated, for, if introduced carefully, the speculum never causes serious accidents. In all cases, the instrument with two or four valves is, in my opinion, the best.

In default of great experience, there is considerable difficulty, no matter what instrument be used, in engaging the cervix in the extremity of the speculum, unless the situation of the neck is first ascertained by the touch. This difficulty is known to result from the fact of the direction of the cervix toward the anterior surface of the sacrum.

The engagement once effected, it is only necessary to separate the valves of the instrument slightly in order to bring the os tincæ into view.

As the touch should have led to anticipate, the changes which the eye detects in the intra-vaginal portion of the neck, are very different in the primiparous female from what they are in one who has had children; we would also add, that the appearance is far from identical at the beginning and termination of pregnancy.

As seen in the latter third of gestation, the neck is generally of a deep violet-red color; and, if it be a first pregnancy, is usually quite smooth throughout its extent; the external orifice is ordinarily more or less rounded, and though larger than in the unimpregnated condition, it barely permits the sight to penetrate its cavity, even though the valves of the instrument be separated considerably. The circumference of the external orifice and the free portion of the neck rarely exhibit signs of ulceration, though it is quite common to observe a series of granulations of a cherry-red color, of sizes varying from that of a large pea to that of a pin's head. These species of vegetations bleed upon the slightest touch with the cotton used for wiping them.

In the female who has had several children, the neck is usually much less voluminous, and it is somewhat difficult to include it entirely in the speculum. The lips of the os tincæ seem divided in several portions, a sort of segmentation caused by the ruptures which occurred in the preceding labors, and which give to the orifice considerable irregularity. In consequence of these numerous solutions of continuity, the opening is much larger, and is dilated with great facility, provided the valves be separated, thus allowing the eye to explore the cavity with readiness.

The walls of this cavity are very unequal, frequently presenting an uninterrupted series of fungous projections, separated by depressions of variable depth. Some of these projections are transparent, being formed probably by hypertrophied follicles; others resemble soft vegetations. The latter are generally covered by an intact epithelium, so that they may be touched without being made to bleed; again, what is by no means rare, they seem destitute of this external covering, and bleed upon the slightest touch.

It is more especially in the furrows which separate these, that linear ulcerations of variable depth are discoverable. These ulcerations sometimes extend over a considerable surface, and are then readily perceived, though they are usually concealed in the depth of the anfractuosities, and, in order to see them, it is necessary, after a thorough cleansing, to unfold the neck, as it were, by expanding the speculum considerably.

According to MM. Gosselin, Danyau, and Costilhes, these linear ulcera-

tions are much less frequent than I had supposed, and are met with in barely more than half the cases, whilst I had observed them in seven-eighths. However, as I stated very plainly, I intended to be understood as speaking only of multiparæ who had reached the latter months, whilst M. Gosselin includes in his statement all stages of pregnancy, and M. Danyau does not appear to have distinguished primiparæ from multiparæ.

Must we admit that, as M. Huguier supposes, we have been deceived? According to this gentleman, a muco-pus of variable consistence is frequently deposited in and adheres closely to the bottom of the furrows observed on the internal surface of the neck. This matter bears a complete resemblance to the bottom of an ulcer; but efface the folds and wipe them well, and the supposed ulcerations disappear. . . . . It is difficult for us to believe that we have been so deceived; still, the assertion of M. Huguier merits serious attention, and shall receive it hereafter.

Unless my observations have been for a long time subject to a series of singular coincidences, it is probable that what we have just described is the normal condition, and should not be regarded as pathological, but simply as a consequence of the progress of gestation. As the violet-red color, the swelling, the softening, and the almost fungous condition of the walls of the neck, are peculiar to pregnancy, and in no wise interfere with its progress, so I regard the ulcerations as a consequence of a physiological process, extreme in degree, and of no greater importance than the other physiological changes.

Especially am I convinced of their non-injurious character, and therefore regard all treatment employed against these ulcerations, even when *fungoid*, as much more hurtful than useful. I say, even *fungoid;* for, contrary to the opinion of M. Coffin, who attributes a great prognostic value to this character of the ulceration, I think that they are fungoid, not because they have a natural tendency to become so, but because the tissue which they affect always presents at a certain period the color and consistence of fungous tissue.

If, therefore, I am not deceived, and if the peculiarities just described really form a part of the pregnant condition, and are merely an exaggeration of the changes which the structure and vascularity of the walls of the uterus undergo at this period, the condition should disappear with the cause which produced it. Like the vomitings, varices, hemorrhoids, and other sympathetic disorders of pregnancy, it should disappear with it. Now this is exactly what happens, and it may be regarded as a principle, that no traces of it remain two months after delivery. The non-specific ulcerations sometimes met with in recently delivered women are of different appearance, and have their origin, in my opinion, in the non-cicatrization of the ruptures which took place during labor.

In short therefore, the fungous condition of the neck, and the ulcerations of greater or lesser depth which complicate this state of the parts near the termination of pregnancy, seem to me to be the consequence of the active or passive congestion with which the organ is affected. I think that, except in a few rare instances marked by specificity of character, or strong tendency to spread,—a tendency, by the way, which I have never observed,—all local treatment should be refrained from.

Is the case the same at a less advanced period, and are the ulcerations which may affect the neck in the early months of an equally innoxious character?

MM. Boys de Loury, Costilhes, Coffin, and Bennett, who have directed their attention more particularly to the ulcerations occurring in the first half of gestation, have been so forcibly struck with their tendency to produce abortion and puerperal diseases, that they class them with the most common causes of miscarriage. Mr. Bennett goes so far as to call them the *keystone* of all diseases of the pregnant female, and the most frequent cause of difficult labors, obstinate vomiting, (see page 465,) moles, abortion, and hemorrhage.

Notwithstanding the smallness of their number, the observations which I have been able to make differ so completely from the results obtained by these gentlemen, that I was tempted to accuse them of some exaggeration. However, after having heard MM. Huguier, Gosselin, Danyau, Cloquet, &c., proclaim the innocence of these ulcerations, I have no hesitation in saying that they have misconstrued the facts observed by them. Finally, we would add, that after having read their observations, there seemed reason for inquiring whether, in many cases, syphilis may not have been the principal cause of the accidents, and in others, whether the frequent introduction of the speculum and the numerous cauterizations which had been practised, may not have played the most important part in the production of the abortions.

I ought, perhaps, to except the peculiar species of ulceration described by my friend M. Richet. All the varieties of ulceration, says this learned surgeon, which are observed in non-pregnant women, may occur during pregnancy; but it has seemed to me that they had a tendency in some cases to assume a fungous character, to excavate the lips of the cervix, to bleed readily, and give rise to serious accidents: abortion, for example. In all my patients, these ulcerations with well-defined edges, and red and bleeding bottoms, were covered with reddish fungosities, which projected between the partly opened lips of the cervix. Of six patients, four miscarried, and two left the hospital apparently cured; of the four who aborted, one only had been cauterized, the three others not having undergone any treatment.

Whoever, like myself, has examined women at the end of gestation, will find the ulcerations observed by M. Richet in the early months, and which he has had the kindness to show me, to bear a close resemblance to those sometimes met with in the latter stages. I see no difference except in the rather greater extent of the ulceration. Their size leads me to suppose that their origin dates back long before impregnation, and their sharp, well-defined edges excite a suspicion of their being specific in character (five of these six women had syphilis at the time, or had previously been affected with it). Now we may readily conceive that under such circumstances the softening, congestion, and fungous condition which pregnancy usually produces at an advanced period, may here take place prematurely, and give to the ulcerated tissues the livid hue and fungous aspect described by M. Richet. Thus, we may understand how such an affection of the cervix, connected most frequently with a general disorder, under whose influence it has a con-

stant tendency to increase, may ultimately give rise to abortion. It also seems to me important to distinguish the ulcerations which existed before pregnancy, and continued, and even increased after conception, from those which were developed after the formation of the germ: the former, in consequence of the irritation which they may suffer as a consequence of fatigue, and especially of too frequent coition, might readily excite the contractility of the uterus and occasion miscarriage; the latter, on the contrary, should, it seems to me, rarely exert such an influence.

I agree, therefore, with the opinion of M. Richet, that when an ulceration presents in the first half of gestation, possessing the characters which he describes, and which, in my opinion, are an evidence of its chronicity, miscarriage should be anticipated, and means be taken to prevent it. Now, aside from a specific treatment in those cases which indicate it, I may be allowed to ask of those who would have these ulcerations treated as a matter of necessity, what are the best local means to be used? Which caustic is preferable? Is not the solid nitrate of silver accused of producing abortion by the partisans of the caustic of Filhos, of the acid nitrate of mercury, or of the actual cautery; and has not each of these latter means also been reproached with giving rise to miscarriage? The thesis of M. Coffin affords some curious details on this subject, and evidently proves, that though cauterization by any agent whatever may claim some doubtful successes, the latter are generally compromised by the abortions which have followed it. From the statements of Bennett and Boys de Loury, the same inference follows. M. Coffin himself, though attributing such great importance to these ulcerations, arrives at this discouraging *therapeutic conclusion*, viz., thus far, no treatment has succeeded, and the question remains open. This, which was true in 1851, is so still; for quite recently we heard M. Chassaignac speak emphatically of the inefficiency of all methods, and M. Richet declares himself undecided as to the best course to pursue.

The insufficiency of local treatment, and the mischievous effect which it may have upon the progress of gestation, should, it seems to me, in the present condition of science, lead us to dispense with it whenever the ulceration has no marked tendency to invade a large extent of the cervix.

CHAPTER II.

DISEASES OF PREGNANCY.

THOSE who have studied the various affections of the womb are well aware that its diseases excite numerous sympathetic disorders. The commencement of the physiological acts which devolve upon it, and their periodical fulfilment, exert upon the functions of the alimentary canal, and upon those of the nervous system, an influence which has for a long time attracted the attention of practitioners. It were useless to mention all the morbid phenomena which so often precede, accompany, and follow the first menstruation. These are more striking when the latter is postponed or difficult. In some

individuals they appear at each menstrual period for a long time, thus seeming to show an impossibility on the part of the organ to perform its functions, without occasioning extensive disturbances of the economy; and it is only, so to speak, when the sensibility of the womb has been blunted by habit, that the return of the menses ceases to produce the general disorders which accompanied it previously.

If the diseases of the organ, and even the simple monthly congestion, are capable of giving rise to such troubles, it is easy to foresee that pregnancy, which changes simultaneously the form, size, and even the structure of the uterus, can hardly pass through its various periods without deeply affecting all the functions.

The effects produced by the pregnant condition vary greatly, as regards both the degree and the nature of the symptoms; all of them being influenced by the constitution of the female. Occasionally, it results in a salutary change in the entire system, better health being then enjoyed than at any other period. In the majority of cases, however, tiresome, or at least very disagreeable symptoms are experienced, which are the expression of the unpleasant influence exerted by the uterus upon important functions. These troubles, which are so slight in some individuals as to amount merely to discomforts, are, in other cases, so great as to injure their health, and even to excite fears for their existence.

These accidents may appear at almost any time; for though some persons begin to suffer at the very outset, and are relieved by the third, fourth, or fifth month, others are attacked only in the latter half of gestation.

The pregnant condition operates differently at the different periods of gestation, in the production of the accompanying discomforts or diseases; this fact, which is important in a therapeutical point of view, was felt vaguely to be so by Burns, but clearly expressed by M. Beau, who, I think, has thrown much light upon the pathology of pregnancy.

Most of the functional disturbances may occur in the early, as well as in the latter months. At first they were regarded as the result of the numerous sympathies existing between the uterus and the digestive apparatus, and, at a later period, the purely mechanical difficulties produced in the neighboring organs by the pressure of the uterine tumor were thought to assist in their production. Now, the pressure of the womb is of quite secondary importance, if, indeed, it be of any whatever; for, according to M. Beau, the following is what usually occurs: The womb, as modified by pregnancy, affects the digestive functions through sympathy, giving rise to the dyspeptic symptoms described hereafter. The disturbance of these results necessarily, if prolonged, in deficient nutrition, which, in a woman who is obliged to furnish the material for the development of the child, must soon occasion a greater or less diminution of the blood corpuscles, and a considerable increase of the serum; in short, to all the anatomical characteristics of chlorosis or polyæmia.

Now, this impoverishment of the blood soon occasions new morbid symptoms in the pregnant woman, as well as in the young chlorotic female, and so serves to explain the reappearance of the disorders of digestion, vertigoes, headaches, congestions of the face, palpitations, and difficult respira-

tion, so frequently observed at an advanced period of pregnancy. We thus see that the functional disorders, which at the outset are purely sympathetic, become afterward intimately connected with the chlorosis which they themselves helped to produce. (See *Disorders of the Circulation.*) Though we shall have occasion to treat hereafter of this latter etiological peculiarity, we cannot help calling attention, at present, to the importance of taking it into consideration in the choice of remedial measures. For, though it be proper at the commencement to reduce the over-excitement of the uterus, and the sympathetic irritation produced by it in other organs, by soothing remedies, as baths, mild laxatives, antispasmodics, and sometimes even by moderate blood-letting, an entirely different course should be pursued toward the end of gestation. All the restorative agents, as iron, animal food, and tonic wines, are here the surest means of opposing the plethora and removing the disorders which it occasions. Still, it is right to observe, that beside the chlorosis, which plays the principal part in the production of the disorders of the latter months, the uterus still retains its sympathetic influence, and is subject at all times to congestions, which increase its irritability, and cause it to react upon other organs; of all which account should be taken in the treatment. The subject will claim attention hereafter.

Finally, the connection which we have endeavored to demonstrate as existing between the sympathetic troubles of the beginning of pregnancy and the chlorosis of the latter months, cannot always be readily discovered. The sympathetic influence of the uterus upon the digestive functions is not always manifested by vomitings, nausea, and strange and depraved appetites. All these symptoms may be wanting, and yet the stomach fail to perform its functions with its normal regularity. Nutrition may be disordered, giving rise to a dyspepsia, which M. Beau proposes to distinguish as *latent;* a dyspepsia which cannot fail to occasion eventually a general deterioration of the blood. Exactly the same thing occurs in young girls whose menstruation is either difficult, irregular, or imperfect. Confirmed chlorosis is always preceded in them by sympathetic disorders of digestion; though sometimes the deranged function is evinced by very marked symptoms, at others it is hardly a cause of discomfort.

Desormeaux, in his excellent article on this subject, ranges all the diseases of pregnancy under the following heads, viz.: lesions of digestion, of circulation, of respiration, of the secretions and excretions, of locomotion, and of the sensorial and intellectual functions. And we propose partly to adopt the same order in our description.

ARTICLE I.

LESIONS OF DIGESTION.

§ 1. Anorexia.

The want of appetite, or the disgust for aliments, which pregnant women are so often affected with towards the end of gestation, and still more frequently at its commencement, may be referred to various causes, and consequently will present different indications for treatment. When it seems to result merely from the sympathetic relations existing between the uterus

and the organs of digestion, there is little or nothing to be done, for it would be in vain to attempt removing the disgust which some patients have to certain articles of food. In general, they dislike all meats, and this is an indication, or rather an obligation, to permit the use of vegetables in such cases. Again, if at an advanced stage, the anorexia be accompanied or preceded by the phenomena of general plethora, venesection, proportioned to the general condition of the female and the stage of pregnancy, may relieve it. Care, however, should be observed not to mistake the symptoms produced by anæmia for the indications of plethora; the former being far more effectually treated by ferruginous preparations. (See *Disorders of the Circulation.*)

In those cases which exhibit evident signs of an overloaded condition of the alimentary canal, some purgative, such as rhubarb, or even the neutral salts, may be administered. Indeed, certain authors have recommended an emetic, when there is any gastric distress; but I think practitioners ought to be very reserved in the employment of this last measure, since the shock of vomiting has often produced abortion.

§ 2. Pica, or Malacia; Pyrosis.

Pica, or malacia, frequently accompanies the affection just described. Pregnant women, like chlorotic girls, often have irregular and depraved longings for the most absurd or disgusting articles. For instance, I have known a young female to eat pepper-grains almost continually. Another, at the Clinique, scraped the walls to appease her cravings for chalk; and M. Dubois often relates in his lectures the history of a young pregnant woman whose greatest pleasure consisted in eating small bits of well-charred wood. Again, they have been observed eating greedily substances that are still more disgusting. Unfortunately, all our persuasions are useless with such monomaniacs in the majority of instances, and consequently we must, as a general rule, grant them an indulgence, and avoid too strong an opposition, unless the coveted articles would evidently be injurious to their health.

I have but little to say of the acidity of stomach, of the spasmodic pains of that organ, and of the pyrosis and other symptoms of gastralgia, which are also quite frequent during pregnancy. The treatment of the symptom is here the same as under ordinary circumstances. Thus, for sour eructations and acidity of the primæ viæ, magnesia and the absorbents, bicarbonate of soda, the water and pastilles of Vichy, may be administered. Pyrosis and cramps of the stomach are usually treated successfully by powdered columbo, and most of the antispasmodics, in connection with small doses of opiates. The latter may also be used after the endermic method.

If, however, it be desired to attack the first cause of these gastralgic symptoms, it is important to remember that this is different for the first and second half of gestation, and that the measures employed should vary accordingly.

§ 3. Vomiting.

The vomiting of pregnancy presents two different forms. In the first, it occasions discomfort and fatigue, without endangering life. In the second,

it is sometimes so severe as to prove fatal. The first we shall term *simple vomiting;* the second, *grave* or *irrepressible vomiting.*

1. *Simple Vomiting.*—This symptom is so common that most females are affected with it; in fact, vomiting frequently commences in the very earliest stages: whence many women, taught by their former pregnancies, recognize it as an almost certain sign of a new gestation. At other times it does not appear until toward the third or fourth month, though seldom later than that; but it is not at all uncommon to see it reappear near the end of pregnancy in some who had been previously tormented in this way at its beginning. As an ordinary rule, the vomiting only lasts six weeks or two months; sometimes, however, it extends over four or five months, rarely persisting throughout the whole term. Some females have the unenviable privilege of vomiting every time they are pregnant; others, more fortunate, pass through several gestations without feeling any digestive disorders whatever. It is a very remarkable fact, if we may rely on the testimony of numerous mothers, that the sex of the child is not wholly irrelevant to the production of this symptom; and however ridiculous this may appear at first sight, I have heard it repeated by so many women that I cannot refrain from believing that it, like most other popular prejudices, has some foundation.

But what is the cause of such vomiting? When it occurs near term, we may justly attribute it to the pressure, to the mechanical constraint which the uterus, whose fundus reaches the epigastric region, exercises upon the stomach; but in the early stages it is much more difficult to explain it unless we content ourselves by referring it to the numerous sympathies existing between the uterus and the stomach: sympathies so intimate that they are manifested in certain women at every menstrual period, and even in nearly all those afflicted with a disease of the womb.

Although the intimate nature of these sympathies is very obscure, we can admit them more readily in the etiology of vomiting than the influence of most of the anatomical causes adduced by some authors. In endeavoring to trace a relation of causality between the vomiting and an inflammation of the uterus, placenta, and membranes, like Dance; softening of the stomach and fatty degeneration of the liver, like Chomel; or, finally, to the existence of organic lesions of parts in the neighborhood of the uterus, observers have merely noticed simple coincidences, without throwing the least light upon the question of etiology. How often, indeed, is nothing of the kind discoverable!

I am persuaded, says Dr. Bennett, that those gastric disorders and obstinate vomitings, which so often bring women to the portals of the tomb, are almost always caused by inflammatory ulcerations of the neck of the womb. For my own part, he adds, since my attention has been directed to this subject, I have *almost invariably* found ulceration of the neck in cases of this kind.

I cannot receive this opinion of the English accoucheur, at least as relating to the majority of cases, for I have frequently examined with the speculum each of four primiparous women affected with incorrigible vomiting, and in whom I ascertained the cervix to be perfectly healthy.

It has been said that primiparous women are more subject to vomiting

than others, on account of the uterus yielding less readily to distention in first pregnancies.

Although this opinion is quite conformable to the theoretical views already given, the fact is, that it is liable to very frequent exceptions. Some multiparæ, who suffered very slight disorders of the stomach in their first pregnancies, have vomited almost constantly in later ones. The rigidity of the uterus is not, therefore, the only cause which is capable of sustaining an irritability of the organ which reacts sympathetically upon the stomach.

I do not think that an epidemic influence can be admitted as a cause of these vomitings.

The vomiting varies much as regards its frequency, intensity, and the greater or less ease with which it is accomplished.

Thus, some women vomit only upon awaking or rising in the morning. They then throw up some viscid or glairy matters, which are generally colored with a little bile, especially if the retchings have been very severe. Others vomit only after eating; occasionally after only one of the daily meals, but sometimes after all of them. Again, in some unfortunate cases it continues even in the intervals of the repasts; everything taken into the stomach, whether liquid or solid, being immediately rejected. There are cases, finally, in which the mere thought of food, or the sight or smell of it, is sufficient to provoke it.

The vomiting is sometimes easy, and causes little pain; it is indeed not uncommon to find ladies suddenly interrupted at their meals, who can return in a few minutes, and sit down and eat with a good appetite and pleasure.

In other cases, however, the ingestion of food is productive of pain in the stomach or inexpressible uneasiness of variable duration, and it is only after five or six hours of suffering, that the food is vomited and then found to be almost unchanged, notwithstanding its long retention in the stomach. In such cases the vomiting is preceded by such prolonged and violent retchings as to reduce the patient to a state of extreme suffering and agitation.

It is occasionally followed by considerable epigastric pain, which is increased by pressure, and might for a moment be taken as a sign of inflammation of the stomach; it gradually diminishes, however, and disappears entirely after a time. The shocks and violent efforts sometimes extend their influence to the hypogastrium, and give rise to abdominal pains and even uterine contractions, which may be active enough to produce abortion.

But it must not be supposed that vomiting, even when prolonged and oft repeated, is necessarily disastrous. No doubt many women waste away, but I have often satisfied myself that the emaciation is not apt to be excessive, by examining females who, according to their own expression, could retain nothing at all; and hence it is exceedingly probable that all the food taken by them is not rejected.

Burns states that he has never known vomiting depend on pregnancy alone to have a fatal termination. I might cite, says Desormeaux, examples of emesis accompanied by cruel pains and violent general spasms, yet the gestation has happily gone on to full term. At this time, I have myself under care a lady who has been vomiting throughout the whole period of gestation, and who has just been delivered of a daughter weighing seven pounds and three-quarters.

Finally, it must not be forgotten that in some cases which even appear serious, the vomiting may cease abruptly, either spontaneously, or because the sympathetic irritation of the uterus has been translated to some other organ, or again, as a consequence of a violent mental emotion. A remarkable instance of the latter has quite recently come under my notice. A young lady, two months and a half advanced in her pregnancy, had been tormented for three weeks with such obstinate vomiting, that, according to her own statement, the smallest mouthful of fluid excited it, and that she was unable to retain anything whatever in her stomach. All the remedies employed against it had proved useless. At this juncture, her husband fell suddenly and dangerously ill with symptoms of strangulation of the bowels, and from this time her vomiting ceased, nor did she suffer the least disturbance of her digestive functions afterwards.

I have been induced thus to hold forth from the outset a favorable prognosis, which indeed is true for the vast majority of cases, in order to relieve young practitioners from the anxiety which some recently published articles on the gravity of this affection are calculated to produce.

2. *Grave or Irrepressible Vomiting.*—The vomiting is not, generally, serious, but only painful and fatiguing to the mother; it must, however, be acknowledged that in some very rare cases, it is so violent and constant as to exhaust the strength of the patient in a few weeks, and after producing extreme emaciation terminate in death.

The display of symptoms given by M. Chomel in one of his clinical lessons, applies to these exceptional cases only. The disease, he says, is characterized by frequent bilious vomiting, an acid, fetid breath, and fever; then the brain becomes involved, and we have delirium, coma, and death.

The views of M. Dubois correspond closely with those of M. Chomel, and, like him, he describes three stages.

[A. *First Stage.*—The irrepressible form of vomiting rarely begins suddenly, but almost always follows insensibly the simple form. The time at which it commences is very variable. Generally appearing during the early months, it may not come on until after the middle of gestation. In 43 cases collected in the excellent thesis of M. Guéniot, hospital surgeon, and former chief of the lying-in hospital, and from which we shall borrow largely, vomiting occurred 9 times during the first weeks of pregnancy, 15 times toward the end of the first month, 9 times between the first and second months, 5 times between the second and third months, 1 time between the third and fourth months, 2 times between the fourth and fifth months, and 2 times between the sixth and seventh months. The first of the cases enumerated are of the early and benignant form, and it is impossible to distinguish accurately the period of transition from the simple to the graver form.

The irrepressible cases present in themselves nothing very characteristic. The vomiting, however, is very frequent, and occasions the rejection of all or nearly all the food and drink which the patient takes. The smallest quantity of fluid is often sufficient to excite it.

The dejections in these cases are composed of mucous or glairy matter, bile or food, according as the bowel happens to be full or empty. Generally they are very acid, and sometimes streaked with blood.

To these symptoms may be added a disgust for or aversion to food, so great as to be often insurmountable.

Soon appear the grave signs of insufficient nutrition: emaciation, debility, and

altered features. Certain accessory phenomena may also complicate the situation such as the almost constant ptyalism indicated by Stoltz and Vigla, and confirmed by an observation of my own.

The first stage is devoid of fever, unless it be a little febrile action in the evening and slight perspiration during the night. We invite attention to this fact, inasmuch as fever is the dominant symptom in the second stage.

B. *Second Stage.*—In this period the symptoms of the first stage grow more severe; the attacks of vomiting are more frequent and violent; the emaciation increases; finally, fever sets in with a pulse of from 100 to 140 per minute. The mouth becomes dry, the thirst is intense, the breath acid and fetid. The acidity and fetidity of the breath are such, says M. Chomel, as to strike one on entering the room of the patient. Still, should we consult our personal experience, we should say the odor is uncommon, inasmuch as we have never observed it in the many cases of irrepressible vomiting which we have seen.

C. *Third Stage.*—In this stage the symptoms undergo a change, the attacks of vomiting ceasing or becoming less severe; but it is a deceitful calm which the experienced physician knows to be the prelude to death. There will, however, be no risk of deception if we but observe that the fever persists with a pusle of from 120 to 140 pulsations per minute. Attacks of syncope and cerebral symptoms soon come on. These are: intolerable neuralgic pains, disordered sight and hearing, hallucinations, delirium, and, finally, coma, which ends shortly in death.

D. *Progress, Duration, and Termination.*—The paroxysms of the graver form of vomiting often remit more or less completely; the remissions being sometimes, as it were, spontaneous, or in consequence of almost insignificant circumstances. Thus an emotion, travel, some change in the mode of life, a new article of food, and numerous similar eventualities seem occasionally to produce a transient amelioration, or even a momentary cessation of the symptoms. The hope thus excited is, unfortunately, but too soon destroyed by a more or less rapid recurrence of the disease. (Guéniot, *Thèse de Concours.*)

At other times these remissions may be attributed to the use of a remedy whose action is exhausted, or the momentary cessation may follow and be due to premature labor or abortion. Then the vomiting returns with increased severity.

The progress of this terrible affection is usually slow, as the patients do not generally succumb until after the second or third month of the disease.

E. *Etiology and Pathological Anatomy.*—We know nothing of the causes of irrepressible vomiting. Some have attributed it to albuminuria, an opinion which nothing goes to confirm, and which would hardly be adopted were it remembered that vomiting is most frequent at the beginning or middle of pregnancy, whilst albuminuria is rarely observed except during the latter months.

Of the silence of pathological anatomy in regard to this disease, I have lately had an additional proof.

A woman with irrepressible vomiting entered my ward, at La Pitié, where I was temporarily on duty. She was delivered spontaneously during the eighth month, but, after a remission, the symptoms reappeared, and she died a few days subsequently. The autopsy, conducted with the greatest care, discovered no lesion in any organ; the genital organs, the abdominal and thoracic viscera, and the encephalon, being perfectly healthy.]

F. *Diagnosis.*—In moderate cases the diagnosis is easy. Here, the absence of acute symptoms, such as redness of the tongue and pain upon pressure on the epigastrium, would settle the question, even were pregnancy doubtful. But if, in the cases just spoken of, the nature of the epigastric pain be misunderstood, the practitioner would be more liable to error; therefore he should be very careful in his proceedings. For example, I

have known a case of vomiting, which the autopsy proved to have been dependent upon tubercular peritonitis attributed to a pregnancy which did not exist. In the case of another female, who had actually been pregnant for two months and a half, the examination after death discovered a serious disease of the stomach, amply sufficient to account for the vomiting. In the latter case, it is true, that an admixture of blood with the matters vomited, had, during life, excited suspicion of organic disease. This very case has, however, been quoted to me by some persons as one of incurable vomiting occasioned by pregnancy. Mistakes of this kind ought not to be made, and the same may be said in regard to epigastric and other hernias.

[G. *Prognosis.*—The prognosis in the grave form of this affection is serious. In 118 cases collected by M. Guéniot, there were 72 recoveries and 46 deaths, represented as follows:

Recoveries.

Without abortion in very severe cases and after a very diversified treatment...	31
Following spontaneous abortion, also in very severe cases.....	20
After abortion or induced labor in cases more or less desperate.....	21

Deaths.

Without abortion.....	28
After abortion or spontaneous premature labor.....	7
After procured abortion.....	11

It is but just to say, that in this table of mortality, M. Guéniot included all the cases he was able to collect, and that amongst them are some in which death was evidently due to some other disease than the vomiting itself.

Cases of irrepressible vomiting are serious from the outset, inasmuch as, notwithstanding all the modes of treatment employed, abortion included, it is impossible to know whether they will be certainly arrested.

The prognosis becomes still more unfavorable in the second stage of the disorder, for when the patients are much debilitated and the fever constant, some will succumb without having either the fetid breath or cerebral disorders. Of such cases, two have come under my notice.

In the last stage, death is almost inevitable, and we ought not to be deceived by the remission of vomiting which then occurs. It should also be borne in mind that the cerebral symptoms which accompany this phase of the disease are various. In two cases, I observed only a little hebetude and slight strabismus without other nervous disturbance: so that, before reaching the correct diagnosis, typhoid fever, or a cerebral tumor might be suspected.]

Generally speaking, even when the vomiting is not so great as to compromise the life and health of the mother, it has but an indirect influence upon the life of the child, nor do I know of a single well-attested case of death of the fœtus from inanition through defective nutrition of the mother.

Still, we may understand how the violent efforts of the mother may sometimes communicate such shocks to the uterus as to bring on premature contractions and even abortion. We can also comprehend how the same efforts may produce vascular congestion of the womb, giving rise to rupture of some of the utero-placental vessels and detachment of the placenta; such accidents are, however, rare. In grave cases, results of the kind are rather to be desired than deprecated, for vomiting generally ceases upon the death of the fœtus, and the mother escapes the threatened danger.

3. *Treatment of the Vomiting of Pregnancy.*—There are but few medicines that have not been proposed, at one time or another, for this affection of pregnant women; and at other times recourse has been had to surgical procedures. We will, therefore, examine successively the medical and surgical treatment.

A. *Medical Treatment.*—When the emesis is slight, and only occurring in the morning, we may recommend an aromatic infusion of the lime-tree, orange-flower, common tea, &c., &c. Where it comes on after a meal during the day, it is advisable to change the order of the repasts: for example, if it be generally more distressing after supper, the patient should sup sparingly and eat more breakfast. Cold aliments are sometimes retained when others are rejected. Iced drinks, mineral waters, and swallowing small pieces of ice, have arrested some cases of obstinate vomiting, which set at defiance the whole series of antispasmodics. The subnitrate of bismuth, in doses of from four to eight grains, before each meal, has appeared to me of late to be of some service. I have also directed two or three spoonfuls of kirsch to be taken after meals, and I think with some success. Should it persist, notwithstanding these measures, a resort may be had to a remedy, which has often succeeded perfectly in my hands,—I allude to the narcotics. About an hour before the meal, let her take one-third or one-half a grain of the aqueous extract of opium made into a pill; but when she is constipated, it will be necessary to administer some mild purgative to counteract any action the opium may have on the large intestine.

Whenever the emesis is attended with pain and stricture at the epigastrium, leeches have been recommended over this part, though I have rarely seen their application followed by any benefit. I should prefer laudanum lotions, or the application of a cataplasm well tinctured with this fluid. Sometimes I have successfully applied a small blister to the epigastrium, and subsequently sprinkled the sixth or the third of a grain of the muriate or acetate of morphia over it.

M. Dezon mentions three cases of obstinate vomiting, which yielded to the continued application to the epigastrium of a towel wet with cold water and renewed every five minutes.

If the vomiting occasions pains in the loins or hypogastrium, in a word, if it threatens an abortion, or if the patient be plethoric, and this condition is manifested by local or general phenomena, venesection in the arm should be resorted to, as this is one of the best measures I am acquainted with, especially during the last half of gestation. Enemata containing laudanum are also very useful for the prevention of abortion, as well as for alleviating the vomiting, and calming the irritability of the uterus. General bathing may be added to these measures with advantage.

Dance reports two cases, from which he feels authorized to conclude that these vomitings are often an evidence of a morbid activity in the uterine system, of an inflammation of the membranes; and consequently he advises direct antiphlogistic measures, especially in the neighborhood of the womb; but as his opinion is founded on two cases only, which, after all, are not conclusive, it seems to me that it cannot be admitted as a rule of practice. Still, leeching the neck of the uterus yielded unlooked-for results in cases of Ch. Clay and M. Clertan (of Dijon).

With regard to the regimen, doubtless a mild liquid diet, composed of aliments that are easily digested, seems at first to possess decided advantages over all others; but how many exceptions! how many women reject the mildest articles—even liquids, and yet readily digest less suitable substances! How often, indeed, have I not seen women eat ham, liver, pie &c., who could not digest a piece of sole, or the white meat of fowl! Of course, we must respect these peculiarities of the stomach.

Among the various measures recommended, but which I have rarely had occasion to resort to, may be mentioned the application of cups to the pit of the stomach (Mauriceau); of a plaster of theriaca (Sydenham); a few spoonfuls of sherry-wine, or even some brandy, ether, peppermint-water, the potion of Riviere, and the colombo root.

In those cases in which there was some degree of regularity in the return of the pains, and febrile action, Desormeaux gave two or three grains of the dry extract of cinchona with success. Lastly, Walter and Blundell have highly extolled the use of hydrocyanic acid in the dose of one or two drops, in some mucilaginous drink, several times a day. With the same idea, I have successfully given kirsch after meals, either undiluted or on a lump of sugar. The latter plan has seemed especially useful when the vomiting was preceded by uncomfortable sensations in the stomach or long-continued nausea—a state of things resembling sea-sickness.

To overcome the acidity of the primæ viæ, M. Chomel recommends the use of alkalies, as the water from the springs of Vichy and Bussang; also dilute solutions of potash and soda, magnesia with milk, but never milk alone, and an avoidance of acids.

Alcoholic liquors, given to the extent of intoxication, have met with real success. M. Rayer tells me that he has used them with great advantage, and champagne wine, recommended by M. Moreau in a case so obstinate as to cause great frequency of pulse and delirium, put an end at once to the symptoms. M. Jacquemin, who related the case to me, considered the patient as lost, and had only called the professor in consultation, in order to obtain his opinion in regard to the propriety of producing abortion.

M. Bretonneau, being induced to try belladonna, in the idea that possibly the vomiting might be occasioned by rigidity of the uterus, succeeded in quieting it, even in very grave cases, by rubbing the abdomen with a concentrated solution of that medicament.

In one very serious case, in which the vomiting had resisted every effort, even Bretonneau's measure, and in which the poor patient seemed doomed to a speedy death, I conceived the idea of applying the belladonna to the neck of the uterus; this was done by means of the speculum. A brush, laden with the soft extract, was introduced, and the neck, together with the inferior segment of the uterus and the walls of the vagina, were besmeared with it. From this moment, a marked change for the better was manifest, and after the same unctions had been repeated on four successive days, I had the satisfaction of finding my patient cured. It is my duty to add, that in another case the same means failed completely, though I think the failure due to the mode of application. When, as in this case, a brush is used, it is difficult to apply the ointment, and too little of it is sometimes

left behind. I have, therefore, for a long time preferred covering a tampon of charpie or cotton with the extract of belladonna, and, after placing it in contact with the cervix by means of a speculum, leaving it there. This may be done morning and evening. The first symptoms of intoxication, such as dilatation of the eyelids, a sense of heat in the throat and slight hallucinations, need occasion no alarm, inasmuch as the effects of the medicament are not felt until then. The patient ought, however, to be watched, and the tampon removed if the symptoms become more serious. This method has been thrice successful in my hands.

M. Stackler overcame the vomiting in two cases by the black oxide of mercury, in the dose of one grain daily. The prolonged use of the remedy was unaccompanied by salivation.

[Iodine in various forms has been recommended. Eulenberg (of Coblenz), following the example of Schmidt, has used the tincture successfully, whilst Ricord and Bacarisse derived equal advantage from iodide of potassium given to the amount of from ten to fifteen grains daily.

"Simpson," says M. Guéniot, "found the salts of cerium very efficacious, especially the oxalate, in 5-grain doses three or four times a day. I would add that the latter salt failed entirely in a case related by M. Danyau, in which it was used by him and M. Dubois, nothing short of a partial detachment of the ovum sufficing to relieve the patient from the danger which menaced her."

Copeman recommends dilatation of the os externum and cervical canal with the index finger, a method which has received the indorsement of Dr. Marion Sims.

Dr. Graily Hewitt recommends appropriate mechanical support to the womb, regarding the vomiting of pregnancy as due to displacements of that organ.

Dr. Jacob Price, in an address before the Penn. State Med. Society, May, 1884, advocated the application, at intervals of three days, of a solution of Iodine, Carbolic Acid, and Tannin, each two drachms, dissolved by heat in an ounce of Glycerine. He regards the *pernicious vomiting* of pregnancy as due to congestion and inflammation of the uterine cervix.]

The obstinate constipation which the patients suffer is very remarkable, and has not received the attention it deserves. The bowels sometimes remain unmoved for eight, ten, or even fifteen days. Strongly impressed with this fact, and supposing that the constipation might have some effect upon the continuance of the vomiting, I endeavored to overcome it; but, fearing the effect of emetics or drastic purgatives upon a weakened and pregnant female, my first efforts were too cautious to be successful. Encouraged since then by the experience of other practitioners, especially by M. Forgue, of Etampes, I have had every reason to be satisfied with a bolder course.

The above-named physician addressed to the Academy of Medicine a memoir, in which he lauded the effect of emetics and purgatives, but insisted much upon what he called a *preparatory treatment*, consisting in the administration to the patient for two or three days, a ptisan of barley-water, weakened with honey, to each quart of which he adds a drachm and a half of sulphate of potash; giving also, morning and evening, an enema of a strong decoction of *mercurialis annua*. When some stools have been thus obtained, he orders a bottle of Seidlitz water containing a grain and a half of tartar emetic, after which he continues the purgative for several days longer. M. Forgue claims to have treated five cases successfully by his method.

I am in the habit of giving the emetic at once, when the saburral condition of the tongue seems to indicate it: which is not often the case. Generally, I order at once ten grains of scammony with fifteen grains of jalap. As the first dose is often rejected by vomiting, I order it to be followed immediately by another, and sometimes even by a third, should the vomiting continue.

The second or third dose is generally retained, and the purgative effect followed by a marked relief.

In the case of a patient two months and a half advanced in pregnancy, to whom I was called in consultation by Dr. Briau, Professor Moreau discovered by the touch that the uterus was not only completely retroverted, but wedged, as it were, in the depths of the pelvic cavity. Suspecting that this displacement might have some effect to maintain the vomiting, he corrected it by lifting the uterus above the superior strait and bringing it into correspondence with its axis. Immediate relief followed, and the vomiting, which had proved intractable to a host of remedies, ceased on the same day, nor did it again return.

M. Moreau said, that he had seen several similar cases. I had indeed myself, before this, observed the same accident, but not having acted upon the indication, our Honorable master conferred a real service in making known the fortunate result which he had thus obtained.

In future, therefore, the state of the uterus should be ascertained in all cases of incorrigible vomiting. Experience has, however, taught me, that although displacement of the uterus often coincides with gastric disorder, M. Moreau's good fortune is not always to be expected. Three times since M. Briau's case have I observed the coincidence indicated by my colleague. In three patients suffering from obstinate vomiting, I found the uterus not retroverted, as in M. Moreau's case, but so far anteverted that the anterior surface of the womb projected considerably at the upper part of the cavity, its upper border resting against the posterior face of the pubis. The reduction, though easily accomplished, could not be maintained, and the organ very soon resumed its primitive position. Several attempts at reduction were equally unsuccessful.

Why, then, was I less fortunate than M. Moreau? I am inclined to think it was because of the different stages of pregnancy in our patients respectively. That of M. Moreau had reached three months or three months and a half; two of mine were only two months gone. Now, if at three months and a half the size of the uterus is sufficient to keep it above the superior strait after reduction, and that it can only, in some exceptional instances, fall back into the cavity, the case is very different at an earlier period. At two months, in fact, the uterus is so much smaller, and therefore so much more movable, that it yields readily to every cause of displacement brought to bear upon it, and, as though by the force of a bad habit, readily resumes its faulty position when the restoring effort is no longer made.

We ought, therefore, in reference to M. Moreau's plan, to have great regard to the duration of the pregnancy; very efficient after the third month, it will generally be useless at six weeks or two months. Unfortunately it happens that incorrigible vomiting is more apt to occur at the latter period.

All my efforts to remedy the difficulty by means devised for keeping the uterus in situ after reduction, have been fruitless. I had made an elongated compress, which, when placed above the pubis, depressed strongly the wall of the hypogastrium, and at first seemed to keep the womb in place. Soon however, it slipped beneath the pad, fell back into the pelvic cavity, and as the bandage thenceforth did more harm than good, I was obliged to give it up.

It was natural to think of Gariel's pessary, but I dared not keep so large a body in the vagina of a pregnant woman, lest it should have the effect on the uterus of a tampon which so often causes abortion or brings on premature labor.

In short, M. Moreau's success in the case related by M. Briau, is an encouragement to make similar attempts, as, after all, they do no harm when prudently conducted; yet, they are not to be relied on when the patient has not advanced beyond the first two months of pregnancy.

I have thus enumerated all these remedies, because they may be successively employed in this affection. In fact, the same medicine may act on one female and have no effect on another. And it must be confessed that sometimes all will fail, and we can scarcely succeed in moderating the patient's sufferings. The change of medicine is, however, useful, either by really calming her distress in a measure, or by sustaining her spirits, not seeming to abandon her, but holding out the idea that each new remedy may effect some amelioration. In this way she gradually approaches towards term, or at least to a period of gestation when the symptoms often disappear of themselves.

B. *Surgical Treatment.*—But where the vomitings continue, notwithstanding all the rational measures resorted to, the woman absolutely throwing up everything she takes, and the privation from food has reduced her to such a state of emaciation as to endanger life, and the symptoms which we have described as belonging to the second and third stages appear, some accoucheurs have advised (if her term is still remote) the production of premature labor. This operation has already been practised, in similar cases, by several English and German accoucheurs, with full success, both for the mother and child.

It seems to me that it cannot be improper to resort to this measure after the seventh month of gestation, for it then appears to be fully justified both by the dangers to which the mother is exposed, and by the possibility of the child living after its expulsion.

But is the case the same before the sixth month, when the sudden termination of pregnancy must necessarily lead to the death of the fœtus. This is one of the gravest questions which can come up in practice. Although fully disposed to sacrifice the child whenever that sacrifice will *surely* save the life of the mother, as in cases of extreme narrowing of the pelvis, I make no hesitation in declaring myself against the production of abortion under the circumstances in question.

I shall proceed to justify this proscription:—

1. When a woman having a contracted pelvis presents herself to a physician, he knows very well that if the pregnancy be allowed to go on until

term, he will have to choose between embryotomy and the Cæsarean operation; also, that in some cases the latter operation will be the only resource. If, after mature consideration of the inevitable consequences of the one and the probable consequences of the other, he decides upon the mutilation of the child, it will doubtless appear to him reasonable not to wait until the increased size of the fœtus at term shall add to the difficulties and dangers of embryotomy; therefore, the production of abortion within the first four months of gestation will seem to be fully justifiable.

But the conditions are different when the life of the mother is compromised by vomiting, however severe it may be.

In the first case, the danger is inevitable; and, unless abortion occurs spontaneously, the Cæsarean operation is the only resource, and we are aware of the usual consequence of the latter. But however intense the vomitings may be, and notwithstanding the state of exhaustion to which they reduce the female, still they are not inevitably fatal. Patients, whose condition justly excited the greatest solicitude, have been known to resist until the latter months and even until the term of their pregnancy, and then give birth to strong and healthy children. Others, whom the vomiting had reduced to a hopeless condition, have been suddenly restored to the most complete health. A case of this kind has fallen under my own notice, and the following was related to me (June, 1849) by M. P. Dubois.

A young German lady, two months and a half pregnant, had been troubled with the most obstinate vomiting from the first two weeks after conception. For the last six weeks especially she vomited almost without intermission; the smallest spoonful of fluid exciting violent contractions of the stomach. She was extremely emaciated and feeble, and her breath was disgustingly fetid; in short, her symptoms were so serious that M. Dubois, who was called in consultation, requested the additional advice of M. Chomel. Both these gentlemen came to a most unfavorable prognosis, and left the patient, under the impression that she had but a few days to live. Some cold applications were the only remedies advised; but the attending physician, being alarmed at her extreme weakness, limited them to slight aspersions. On the second day after the consultation the patient was attacked with violent purging, and from that time the vomiting ceased and never returned. The poor sufferer was at once able to take and retain some nourishment, which, being gradually increased in amount, soon restored her strength. Now, this woman, who had been so greatly reduced that two eminent men regarded her fate as sealed, is in the enjoyment of perfect health, and has almost reached the middle of her pregnancy with every prospect of a happy termination.

In two other cases, which the professor related with commendable frankness, he had deemed it his duty to propose the induction of premature labor. The women declined submitting to the operation, and reached the end of their pregnancies in good health.

2. When abortion is produced in cases of extreme contraction of the pelvis, there is a certainty that, when once accomplished, all the dangers which threatened the termination of the pregnancy are at an end, and that only the usual consequences of miscarriages can follow from the operation.

Even supposing that the artificial means should add to the ordinary risks of spontaneous abortions, the object is nevertheless certainly attained in terminating a pregnancy whose progress so greatly endangered the mother's life.

The conditions are very different in cases of spontaneous vomiting, for if all the instances on record be referred to, it will be found that the operation is far from removing the danger. I am well aware that four or five fortunate cases have been cited from the practice of English accoucheurs, but we are not told how often it has been followed by death.

Are the circumstances the same in cases of obstinate vomiting? If unsuccessful, the operation was performed too late, say they, when the prolonged defective nutrition of the mother had exhausted the vital powers; and had the uterus been emptied sooner, the chances of success had certainly been greater.

I believe this fully; but here it is that the most difficult question arises. When is the operation proper? If you act too soon, may it not be said, whilst instancing the cases of spontaneous cessation of the vomiting, as in those which have been quoted, that you have destroyed the fœtus without advantage? If you act too late, may you not be equally reproached, in view of the failure of all known operations, with an attempt which may have hastened the fatal termination?

Where will the prudent practitioner place the limit of expectancy? If it be remembered that the ancient accoucheurs declared, as do Mauriceau and Delamotte, that the vomitings may possibly produce abortion, yet are not dangerous for the mother; also that many moderns assert, with Burns and Desormeaux, that they have never known them to terminate fatally, there would certainly be small temptation to operate before all hope has been dissipated by the gravity of the symptoms. Our hopes, indeed! But does not nature sometimes mock at our expectations? Did not the patient of MM. Dubois and Chomel seem doomed to certain death?

I know it may be answered that it must be left to the tact and skill of the practitioner to think deeply, and choose conscientiously between the dangers of expectation and the chances of an operation; that the difficulties which I raise, present in a host of surgical cases; that there is barely an amputation which may not be authorized by affirming, *dogmatically*, that a spontaneous cure is impossible; that the exceptional preservation of a limb proves nothing against the propriety of amputation in a majority of similar cases.

All this is doubtless true; but let us not decide too quickly, for the comparison is far from being strictly just.

When the surgeon has to deal with a serious traumatic lesion, he regards nothing but the interest of his patient; and after explaining to him the grounds of his conclusion, may, in cases of difficulty, consult his wishes, and then leave his life at his own disposal. The accoucheur has the serious interest of two beings to care for; and though the instinct of self-preservation may silence in the female the voice of maternal feeling, it is nevertheless his duty to protect the fœtus, with whose welfare he is equally intrusted.

In a given traumatic lesion, all experience shows that spontaneous recovery

is a rare exception. On the other hand, the experience of all accoucheurs goes to prove that the spontaneous cessation of vomiting is of almost universal occurrence.

Dubois met with 20 fatal cases of intractable vomiting in 13 years. Tyler Smith mentions two cases that died before abortion could be induced (*Leishman's System of Midwifery*).

[We shall proceed no further with this discussion, but first of all examine the facts. Experience having shown that abortion and spontaneous labor were, in cases of obstinate vomiting, often followed by recovery, it was naturally asked by physicians whether the process adopted by nature might not properly be effected by art. Some trials having been made here and there, M. Dénieux succeeded in collecting 32 of them, which he quotes in his thesis, giving as a result 21 recoveries and 11 deaths. Of the 21 successful cases, 15 were abortions, and 6 premature labors. To these we would add a case of our own, in which the vomiting being severe, and death imminent, it was decided, in consultation with Drs. Millard and Charrier, that abortion should be produced. The operation was successful. It was a twin pregnancy of two months duration.

Our conclusion is, that procured abortion, as well as premature delivery, is a valuable resource in intractable vomiting. It is nevertheless true that it has the great disadvantage of certainly sacrificing the life of the child; therefore, before undertaking the operation, the conviction derived from mature consideration that no other course remains by which the mother's life can be saved, should be sustained by the concurrence of several medical friends in consultation.

It is, in fact, more difficult under these circumstances than in a case of extreme contraction of the pelvis to determine the propriety of producing abortion, and that, too, without having the same certainty of saving the patient. We shall not revert to the comparison of such cases, already made on page 474.

Another difficult question remains to be settled: At what time ought abortion to be effected? In reply, we can do no better than quote the opinion of P. Dubois. "The production of abortion in the third stage of the disease is liable to the grave objection of not saving the patients, but of hastening their end and compromising our art. If done in the first stage, there would be the not less serious error of sacrificing a pregnancy which might, perhaps, have progressed happily to its term. Therefore, we conclude that the operation is applicable to the period intermediate to those mentioned." We would here call to mind that this second period is characterized: 1, by almost incessant vomiting, produced by all kinds of food, and sometimes, also, by the least quantity of pure water; 2, by debility so great as to keep the patient at rest, and occasionally by syncope; 3, continued fever; 4, in certain cases by a fetid and even putrid breath. When to these symptoms is added the failure of all the medication which has been tried, it is right to advise abortion, leaving with the family the responsibility of deciding upon it as a last resort.

Different operative procedures may be employed, the comparative value of which will come under discussion hereafter. (See *Operations.*)]

§ 4. Constipation. Diarrhœa.

Constipation is a very common affection in pregnant women, and it is usually attributed to the pressure of the developed uterus on the upper part of the rectum, by which not only the calibre is diminished, but its action is also paralyzed. Would it not be more reasonable to attribute it in many cases to a commencing chlorosis? We know, indeed, that constipation is so common in the latter disease that Hamilton regarded it as one of its causes.

Some authors attribute it to diminished secretion of bile. When carried too far it often produces anorexia, and disordered digestion, and becomes a cause of agitation and loss of sleep. Whatever be its cause, the straining, necessary to expel the hardened fæces that have accumulated in the intestine, may give rise to hemorrhage and abortion.

The best measures for preventing and remedying this state are nearly identical with those used at other periods of life.

The same remarks apply to the diarrhœa with which women are often tormented.

[Constipation, as just said, is very common during pregnancy. Diarrhœa sometimes occurs, and that more frequently than seems to be generally suspected.

The diarrhœa of pregnancy varies in character, and is due to different causes. Sometimes it alternates with the constipation which gives rise to it, and which is relieved thereby. At other times it coincides so nearly with conception as to be its first symptom; again, it may appear only during the last days of gestation, and indicate the imminence of labor. In none of these forms does it present any gravity, and is amenable to the treatment usually employed in such cases.

Exceptionally, however, severe diarrhœa may supervene during pregnancy, without any assignable cause. The passages are profuse and frequent, and accompanied with tenesmus; emaciation takes place with exhaustion of strength, the mouth becomes dry, and fever sets in.

Some of these cases resist all kinds of treatment, and may lead to abortion or premature labor. This form, to which the term intractable might well be applied, may prove fatal to the mother either before or after delivery. One case of the kind has come under our own observation.]

ARTICLE II.

LESIONS OF RESPIRATION.

Cough and dyspnœa are about the only affections claiming our examination under this title.

The dyspnœa that supervenes towards the end of pregnancy is evidently produced by the crowding of the lungs from the excessive uterine development, and the delivery alone can cure it; but sometimes it is sooner manifested in consequence of a pulmonary congestion, which must be remedied by general blood-letting, a light regimen, repose in a suitable position, and loose clothing.

The same may be said of such palpitations as are not due to organic disease which existed before the pregnancy; but it must not be forgotten that, though bleeding is useful when the dyspnœa or palpitations are very severe, by diminishing the local congestion for the time, the latter is much more frequently due to hydræmia than to a true plethora, and that the best means for preventing its return is to follow the bleeding by tonic remedies. (See the following article.)

As to the cough, it is only dangerous as regards the pregnancy, by the violent jars sometimes given, which may produce an abortion. Indeed, all observers who have written on influenza have carefully noted the frequency of this accident in women who were affected with it.

When the cough is the effect of pregnancy, it may sometimes be attributed

to local plethora, and then we should bleed. But at other times it has a spasmodic character resembling whooping-cough, with the exception of the alteration of the voice. In such cases, I have derived much advantage from baths, repeated for several days in succession.

When it is the symptom of a chronic malady, existing prior to gestation, the treatment will vary with the disease that produced the cough. Whatever may be its origin, the accoucheur should always resort to such demulcents and pectorals as are calculated to diminish its intensity.

ARTICLE III.

LESIONS OF THE CIRCULATION.

§ 1. ALTERATIONS OF THE BLOOD. PLETHORA AND HYDRÆMIA.

The general circulation is more active in pregnant women than in others (see page 157), and this increased activity manifests itself by a greater frequency of pulse, which is often harder and fuller than in the non-gravid state. Though all this may be regarded as normal, it sometimes becomes exaggerated and gives rise to a slightly morbid condition. Thus, some women experience, at the same time, vertigo, dimness of vision, ringing of the ears, sudden flushings of the face, spontaneous heats over the body, but more especially of the head. If bleeding be practised under these circumstances, the blood will sometimes afford a large and consistent clot with but little serum; though much more frequently there is much serum, and a small clot, covered with a distinct whitish coat, resembling that observed in inflammatory diseases. (See page 160.)

The differences in the appearance of the blood drawn by venesection ought to have excited the suspicion that, notwithstanding their identity, these functional disturbances might be produced by different causes; and although some scattering therapeutic measures induce the supposition that the idea had suggested itself to some good minds, it is also evident that it was almost immediately stifled; for the majority of authors, even the most recent, do not hesitate to refer them to plethora, and making the treatment correspond with the etiology, recommend blood-letting as the best means of overcoming it.

The little advantage which I had derived from this practice had, for several years, excited doubts in my mind as to the value of the theory; which doubts were especially increased by reading the admirable investigations by M. Andral on the blood. Therefore, in treating, in 1844, in the second edition of this work, of the plethora of pregnant females, I wrote as follows: "After having read the curious statements just given (*analysis of the blood by M. Andral*), the reader will perhaps find them to disagree with the title of this paragraph, and possibly also with the therapeutic measures hereafter recommended; for how, indeed, can we reconcile this denomination of plethora, applied to the totality of the phenomena observed in most gravid females, with the evidences of anæmia furnished by the analysis of the blood? *Is it not probable that the profession has heretofore been in error*, in attributing to this cause what in fact is only due to an impoverishment of

the blood? Because, if to these results we add the beating of the carotids, the caprices of the stomach, the digestive disorders, and the varied nervous phenomena that occur during pregnancy, and which closely resemble those so often observed in chlorotic patients, are we not *irresistibly* brought to the conclusion, that the chlorosis which produces them in the one case also does in the other? and, consequently, that the bleeding generally recommended is more likely to augment than to diminish such disorders? A sufficient number of facts are still wanting to decide the question satisfactorily; but, while presenting in this work the views most generally received, we cannot conceal the effects produced on our mind by the experiments of Andral and Gavarret."

From that time we have endeavored to test by facts the inferences which we had drawn from the documents furnished by the experiments of these two learned professors; and we have to say, that the theory is confirmed by practice. Therefore we now assert boldly, what we before expressed timidly in a simple note: *That hydræmia is the most frequent cause of those functional disorders of pregnant women which have hitherto been attributed to plethora.*

However strange this proposition may at first appear, it seems to us to be proved by the results of the chemical analysis of the blood, by the symptoms presented by the patients, and by the happy effects of a tonic treatment.

It is now well proved that the essential character of plethora is based upon a great increase in the proportion of the blood corpuscles, as their diminution is the distinctive fact in anæmia. And it is well known that diminution of the corpuscles and increased proportion of water are the essential characteristics of anæmia and chlorosis. Now we have shown (pp. 157 and 159) whilst describing the changes in the blood during pregnancy, that the amount of corpuscles diminishes, whilst that of water increases. In this respect, therefore, pregnant women may be strictly compared with those affected with chlorosis. The increase of fibrin and diminution of albumen also observed during gestation (see pages 157 to 159), are of more difficult explanation.

The deficient nutrition of the mother, who is obliged, whatever may happen, to supply the fœtus with the food required for its development, may also explain the excess of fibrin, and in addition, the decrease of the corpuscles; for the experiments of M. Andral have shown that the blood of dogs, subjected to certain degrees of abstinence, presented the characters of chloro-anæmia, and coincided with a marked increase of the fibrin. Again, if we admit, with some modern chemists, that the fibrin is formed at the expense of the albumen of the blood, may we not find in the considerable diminution of the latter the cause of the increase of the former?

Finally, we would add that MM. Becquerel and Rodier, the only observers whose analyses give the proportion of iron in the blood of pregnant women, have shown that it is below the physiological average. Thus, in 1000 grammes of the calcined blood of a healthy and non-pregnant woman, the average proportion of iron is 0·541; in that of the pregnant female it is 0·449; and in well-marked chlorosis it is 0·366. The proportion of iron

follows, therefore, that of the corpuscles, and the expression of its amount during pregnancy will serve to indicate the transition from the healthy condition to confirmed chlorosis.

From all that has been said, we think it may be concluded that the principal elements of the blood undergo alterations during pregnancy analogous to those of chlorosis. These changes are doubtless in many cases purely physiological, as we have already stated (see page 159), but may so increase as to become pathological by the establishment of hydræmia and chloro-anæmia.

The view which we take will become still clearer when we shall have proved the following proposition.

The Functional Disorders of Pregnancy hitherto attributed to Plethora are those of Chlorosis. Most of the authors who have written upon the functional disorders of pregnancy have attributed them to plethora, on account of the peculiar physiognomy which they present. Thus, because in many pregnant females they observed fulness and hardness of the pulse, a feeling of heaviness in the head with somnolence, vertigo, ringing in the ears, flashes of heat, sudden flushings of the face, &c., they regarded them unhesitatingly as the expression of encephalic congestions, themselves the consequence of general plethora.

Now it is really only necessary to read the list of symptoms belonging to chlorosis, in order to be convinced that they are identical for the two affections.

This is easily explained, says M. Andral, by observing that if the mere passage of too great an amount of corpuscles through the vessels of the brain appears to account sufficiently for the cerebral disorders witnessed in plethora, it follows that too small an amount of corpuscles traversing the same vessels will produce similar disorders; so that too great or too small an amount of corpuscles deranges certain actions of the brain in the same manner. Therefore, the true cause of the symptoms is not to be judged of by their external characters, but only by the changes in the blood. Now, the analysis of the blood of a large number of females, who complained of these supposed plethoric phenomena, has shown a marked diminution of corpuscles and an increase of serum.

Besides, if we remember what has already been said concerning the pathology of pregnancy, it will be found that there is hardly one of the functional disorders yet studied, which is not also observed in chlorotic women. What is more common than to find in chloro-anæmic patients the want of appetite, disgust for food, whimsical and depraved tastes, cramps and pains in the stomach, nausea and vomiting,—in short, all those symptoms of gastralgia which render many pregnancies so suffering? Are not also the headaches, toothaches, faintings, and the facial, frontal, orbital, or temporal neuralgias, common, so to speak, to the two conditions? As regards the circulation, do we not observe the same modifications in the strength of the impulse, the rhythm, and the clearness of the pulsations of the heart, and is not a bellows murmur also heard in the principal vascular trunks?

Some of these various disorders, such as the nervous phenomena, are more

particularly observed in the first half of pregnancy; others, such as the pretended symptoms of plethora, trouble more especially those females who have reached a more advanced period. It must, however, be confessed, that sometimes all of them appear at the beginning, and sometimes at the end of gestation, which fact some persons have thought to militate against my theory. Why, said M. Jacquemier, should the same symptoms, which are regarded as disorders due to sympathy with the uterus, if they appear during the first half of pregnancy, be considered as caused by chlorosis, if they appear during the second half? Is there not something arbitrary and artificial in this,—something which seems to have been devised expressly for the support of a theory?

In the first place, I would observe that I have only spoken of the uncomfortable sensations which women experience in the latter months; but in supposing the similarity of the symptoms, there is nothing irrational in attributing to them a different origin. I may be allowed to recall what takes place in the case of a young girl becoming chlorotic: it will be seen that the succession of phenomena is absolutely the same as what I have supposed for the chlorosis of pregnant women. A healthy young girl reaches the age of puberty, when, under the influence of causes which we often cannot appreciate, the menstruation fails to become established, or takes place only in an imperfect or irregular manner. The uterus, being disturbed in the exercise of its monthly functions, soon reacts upon all the other organs. The appetite diminishes, the stomach becomes capricious, the tastes whimsical, the digestion painful; and from the persistence of this difficult digestion results incomplete assimilation, and soon deficient nutrition. After the lapse of a few weeks or months, the defective nutrition produces an alteration in the composition of the blood, which, when carried to a certain degree, produces all the symptoms of chlorosis,—symptoms bearing a strong resemblance to those which preceded and caused the general disease of which they are the expression.

No one, certainly, will deny the truth of the picture just drawn. Now, is not the same succession of phenomena witnessed in pregnancy? In both cases, is it not the irritation of the uterus produced by the new functions, which first reacts upon the other functions of the economy, disturbing their regular fulfilment, which afterward interferes with the assimilation of nutritive matters, and which finally produces chlorosis? Is not the latter condition indicated in the pregnant woman, as in the young girl, by the same symptoms? Where then is the difference? And if it be allowed that the primary functional disorders of the young girl are purely sympathetic, whilst those which occur later are attributable to chlorosis, why should we refuse to acknowledge the same as occurring during pregnancy?

After thus recalling the fact, that all the functional disorders of chlorosis are sometimes observed during pregnancy, it truly becomes a matter of astonishment that the resemblance between the two should not have been noted earlier, and that it should have been left for recent analyses to excite the suspicion that the same symptoms might be due to the same cause.

The pathological anatomy and symptomatology being then in accordance with each other, it remains to be seen whether the treatment will afford another evidence of the nature of the disorder.

Plethora was formerly considered so common, and so exclusively the cause of the diseases of pregnancy, that blood-letting had become a general practice. So strongly impressed were many women with the idea of the necessity of bleeding, that they thought themselves under an obligation to have recourse to it by the time they had reached the fifth month of gestation, and even demanded it before consulting their physician. Most practitioners declined performing these so-called preventive bleedings, though all regarded venesection as the best means of overcoming *plethora*, that is to say, the assemblage of phenomena attributed thereto. If the latter proposition were true, it would constitute an unanswerable objection to the theory we are endeavoring to establish. Fortunately, however, such is not the case.

I certainly do not wish to deny the amelioration produced by bleeding in certain cases; but it proves nothing against the poverty of the blood, and the chloro-anæmia. The lessened proportion of the corpuscles does not necessarily involve a diminution of the entire mass of the blood, as the word *anæmia* applied to this alteration would seem to indicate. Generally, on the contrary, the amount of this fluid remains the same, and sometimes even is considerably increased; thus corresponding with what M. Beau states to be habitually the case in chlorosis. A true plethora, which might be styled *serous*, then exists, in which case, especially to the usual signs of anæmia, are superadded headache, vertigo, ringing in the ears, etc.; and under these circumstances, bleeding may afford relief by diminishing the amount of blood. The same result is obtained in ordinary chlorosis, when bleeding is practised for the removal of local congestions. But, in pregnancy as in chlorosis, this alleviation is but temporary, and if the proportion of corpuscles be not brought up to the healthy standard by proper hygienic and therapeutic measures, the same symptoms will soon reappear, and with greater intensity. The abstraction of blood is, therefore, in any case, but a palliatory measure, only to be employed in extreme cases, when the general symptoms are very severe, but which might have been avoided by administering tonics and ferruginous preparations at an earlier period.

An animal diet, and preparations of iron, have, for six years back, always appeared to me to be quite as useful against the functional disorders of pregnancy as against those of chlorosis. Unless they be very serious, I no longer bleed for palpitations, pains in the head, or suffocations, nor have I known them, in a single instance, to resist the use of the preparations of iron longer than a couple of weeks. Even when the gravity of the accidents has obliged me to bleed to the extent of six or eight ounces at the utmost, I begin immediately with the use of iron, and it is very rarely that I am obliged as formerly to recur to venesection. Hemorrhage from the bowels might, in some cases, remove the necessity for phlebotomy, and M. Blot was certainly right in advising gentle purgatives under these circumstances.

There is still another condition, in which I have associated iron and bleeding with advantage; with what propriety we shall next see.

The excess of impoverished blood in pregnancy may, as in chlorosis, give rise to local congestion, which congestion, when carried beyond certain limits, explains the occurrence of epistaxis, and the less frequent hæmop-

tysis and hæmatemesis, all which seem to be the result of an effort on the part of nature to diminish the vascular fulness. These accidents are unusual during pregnancy, or, at least, rarely occur to an alarming extent. The reason seems to be, that from the moment of conception until delivery, all the vital powers appear to be concentrated upon a single organ, which forms a centre of fluxion, towards which all the troubles of the organism converge; this organ is the uterus. The congestion, which in the chlorotic patient occurs in the head or the chest, here takes place in the womb; and the extraordinary development of the vessels of the uterus, and their more or less intimate connection with those of the fœtus, sufficiently explain the danger of an over-determination of fluid. At a very early period, the congestion may occasion the rupture of one of the numerous capillary vessels distributed upon the internal surface of the mucous membrane (parietal or epichorial decidua); rather later, the congestion may be great enough to rupture one of the utero-placental vessels, and in both cases give rise to an effusion, which, by destroying wholly or in part the utero-placental relations, proves fatal to the child.

These uterine congestions, which are properly considered, in some cases, as the consequence of *general plethora*, I have witnessed much oftener in feeble and anæmic women. They almost always appear at the menstrual periods, as though the monthly periodicity excited at those times a more active vitality in the uterus. The woman complains of tension, of swelling of the abdomen, of a feeling of weight in the pelvis, the groins, and upper part of the thighs; she also soon suffers pain in the region of the kidneys and in the loins. If the proper measures are not employed, the vascular congestion, and the pressure upon the uterine walls resulting from it, irritate the organ; slight contractions occur, sometimes even a little blood flows from the vulva, and announces a threatened abortion. These symptoms are almost always accompanied with marked vesical tenesmus. Can the latter be due to pressure on the neck of the bladder, produced by an increase in the size and weight of the uterus caused by the congestion?

It is evident that when these symptoms of uterine congestion appear, prudence dictates a recourse to all the means likely to effect a revulsion. Thus, sinapisms to the upper and posterior part of the back, seven or eight dry cups to the upper part of the chest, and finally, if these measures are insufficient, bleeding, to the extent of six or eight ounces, as a powerful revulsive, is very useful. But, even here, the bleeding may have only a momentary effect by destroying the local plethora, and by no means enables us to dispense with medicines capable of modifying the state of the blood. We shall return to this subject under the head of *Preventive Treatment of Abortion*. It is proper, however, that I should say in this place, that many of my patients who had suffered frequent miscarriages, have been enabled to attain their full period by the use of iron administered from the beginning of pregnancy.

We see, therefore, and I call the attention of practitioners to this point, that if the medicament which cures a disease sometimes also proves its nature, then the disorders which we have described are oftenest due to chloro-anæmia, and not to plethora. The latter proposition, confirmed as

it is by pathological anatomy and symptomatology, I hold to be incontestable.

I say oftenest, for I would not have my assertion regarded as absolute. Though true plethora, that which is distinguished from serous plethora by an increase in the amount of the corpuscles, be rare, it nevertheless is sometimes met with, especially at a very early stage of gestation. Females of a really plethoric constitution, whose menstrual discharge is habitually abundant and high-colored, may retain this constitutional peculiarity during pregnancy, and sometimes even have it increased. The sixty odd analyses which we have quoted, show that, in several instances, the proportion of corpuscles underwent no diminution in the earlier months, and that in the case of one woman who had reached the end of the second month, M. Andral found them increased to one hundred and forty-five. It is even probable that, when analyses shall be more numerous, the same peculiarity will be remarked in some cases of advanced pregnancy. For my own part, I have certainly met with females whose antecedents, symptomatic expression, and the physical properties of whose blood afforded every indication of plethora.

The fact of our having observed but few instances of the latter class, is explained by our practising in the metropolis, where all debilitating influences are collected. The hygienic conditions in which women live in the country, dispose them less to chlorosis, and it is exceedingly probable that their blood is not so much altered during pregnancy as in the cases we have noticed. To this, I think, is certainly due their exemption from the functional disorders, nervous or otherwise, which so commonly affect the females of large cities. This is an additional argument in favor of my theory.

Though such women are exposed to the general consequences of plethora, they present more frequently the signs of local or uterine plethora, especially during the first half of pregnancy, at the periodic returns of the menstrual periods. The local phenomena, as tension, swelling of the abdomen, feeling of weight in the pelvis, are very strongly marked in their cases. The circulation of the fœtus also, sometimes, appears to share in the troubles of the maternal circulation, for these signs of congestion are frequently observed to be followed by the weakening, diminished frequency, and even complete cessation of its active motions; and if the motions have not yet been perceived, the plethoric condition may greatly retard their appearance. However difficult the explanation of these peculiarities may appear, they are too common to be doubted. The best proof that can be given of the effect of this local congestion upon the motions of the child, is their prompt reappearance after a venesection made at the proper time; and it very frequently happens that a woman who is five months, or five months and a half, gone, without having felt them, perceives them suddenly after bleeding.

It is unnecessary to state that here blood-letting constitutes the proper treatment, and that the quantity abstracted may be regulated by the circumstances of the individual cases. It is, however, better to practise several small bleedings at short intervals, than to depend upon a single copious one. The production of syncope should be studiously avoided.

We shall have occasion, when treating of abortion, to finish the study of the therapeutical indications. (See *Abortion.*)

To recapitulate, the functional disorders of pregnancy, as cephalalgia, giddiness, vertigo, ringing in the ears, dyspnœa, palpitations, &c., are rarely due to true plethora, but most generally to chloro-anæmia. We might indeed distinguish for pregnant women a very rare *sanguineous plethora*, and a very common serous plethora.

Independently of this marked diminution of globules and albumen, the blood is sometimes considerably altered by admixture with the elements of the urine. This alteration, which has been described of late by the Germans under the title of *uræmia*, and of which we shall soon have occasion to speak, is a capital fact in the etiology of several diseases which are liable to appear in the puerperal condition. We merely state the fact for the present, leaving further notice of it until we come to treat of the lesions of the urinary secretion.

§ 2. Hemorrhage.

[Hemorrhage from the genital organs is, unfortunately, but too common during pregnancy, and is an accident much to be apprehended. The hemorrhage may assume very different features according to the cause which produces it and the time of its appearance. On this account it would be so difficult to treat of it in a single chapter, that its history must necessarily be divided into several articles, which we think it best thus to indicate at the outset. Sometimes the effusion of blood is confined to the placenta, and has already been described as placental apoplexy with the other diseases of the placenta (see *Diseases of the Ovum*). Uterine hemorrhage occurring during the first six months of gestation should, if it be somewhat profuse, excite fears of abortion, which it often gives rise to or accompanies. Under these circumstances it is impossible to separate the study of the hemorrhage from that of the abortion. (See *Abortion*).

Hemorrhage occurring during the three last months of gestation presents, on the other hand, the same symptoms, and requires the same treatment as though it occurred during labor. One description, therefore, suffices for both, and will be given in connection with the history of other accidents which are liable to occur during labor. (See *Dystocia*, article Hemorrhage.)

Again, rupture of varicose veins of the vulva and vagina gives rise to effusion of blood in these organs. Such an effusion is known as a *thrombus*. As it rarely occurs except during labor, we refer the account of it also to the article on Dystocia. (See *Dystocia*, article Thrombus.)

We shall merely refer in this place to a rather rare and curious form of uterine hemorrhage. Some women have a discharge of blood from the vulva a few days after conception. It is small in amount and is sometimes intermittent and sometimes continuous; it is rarely attended with clots, but resembles a moderate menstrual flow. It sometimes lasts for three or four months without interruption, yet neither gives rise to serious symptoms nor interferes with the course of gestation; finally it ceases without assignable cause. In our opinion, the discharge has its source in the neck of the uterus, which, in these cases, has appeared to us both large and softened. The explanation would at least seem probable, when we remember how readily blood exudes from the os tincæ when a pregnant woman is examined by means of a speculum. An ulceration of the cervix would facilitate the discharge of blood. It requires no treatment, the greatest danger being that it might lead to the belief of the non-existence of pregnancy.]

§ 3. VARICES. HEMORRHOIDS.

A varicose condition of the veins in the lower extremities, the vagina, and inferior parts of the rectum, is quite a common occurrence towards the latter part of gestation, though, as regards treatment, the varicose veins in the limbs only require the usual precautions to prevent their rupture. For this, methodical compression is the best remedy, and every attempt at a radical cure should be discountenanced.

[Varicose veins of the limbs sometimes burst during pregnancy, and the resulting hemorrhage is almost always serious in consequence of the pressure of the uterus on the iliac veins. Though some cases are said to have proved fatal, any hemorrhage of this kind is generally easily arrested by well-regulated pressure applied to the seat of the injury.

The veins of the vulva, always dilated during pregnancy, sometimes become varicose, giving the sensation of well-defined cords. No annoyance usually results, though some women complain of a very uncomfortable feeling of weight whilst standing. Moderate pressure by means of a T bandage almost always affords relief.

Rupture of one of these varicose veins may give rise to severe hemorrhage or even death, as in the following case which came under our notice at the hospital of the Clinique. A pregnant woman, in other respects in good health, was affected with varicose veins of the vulva. One evening, whilst about retiring, she attempted, whilst sporting with some of the other women in the dormitory, to leap from her bed. Falling backward, she found herself seated upon a chair, the edge of which had struck against the vulva. A hemorrhage so severe as to prove fatal in a short time, was the immediate result. At the autopsy, the only lesion that I could discover was a contused wound about half an inch in length upon the external surface of the left internal labium. Water injected into the primitive iliac vein escaped rapidly from the little wound just mentioned. Had the cause of the hemorrhage been discovered as soon as the accident occurred, the effusion could have been certainly stopped by pressure directly applied.

As the rupture of the veins of the vagina and vulva occurs most frequently during labor, we refer for further particulars to the subject of *Thrombus*. (See *Dystocia*.)]

Hemorrhoids, like varices, are an ordinary consequence of the uterine pressure on the hypogastric vessels; but they may likewise be frequently produced by constipation, and the attendant accumulation of hard matters in the rectum. The bleeding piles are generally less disastrous; but the others are more grave and very painful. In fact, it often happens that women affected with them can neither stand nor walk, and they are even troubled when seated.

The first indication is to combat the costiveness, and then to assuage the pain by tepid bathing, cataplasms, and emollient and narcotic lotions, or the poplar ointment may be applied to the tumors; and where they are internal, a suppository of cocoa-butter might be introduced into the rectum. Liniments containing opium and belladonna will frequently relieve the patients; but this is all that we could prudently do under the circumstances.

When the inflammation and turgescence are very great, bleeding in the arm is advisable, as this is much preferable to the application of leeches in the immediate neighborhood of the tumor; true, the latter calms the pains

temporarily, but then, in certain females, they might bring on an abortion. I have never known, says Desormeaux, the application of leeches on the tumors, or the incision of the latter, to procure any durable relief.

Where the irritation from the piles seems to react on the womb, and threatens a uterine hemorrhage, M. Gendrin has derived signal advantage from cold applications around the pelvis. In those cases, says he, if the hemorrhage is imminent, we augment the activity of the topical remedies placed directly over the parts affected, by using cold baths to the breech at the same time, the temperature of the water never having been lower than 12° or 15° (Centigrade, equivalent to 54° or 59° Fahr.). I have several times employed cold injections successfully. The plan is to take every evening a large cold enema, which after being discharged is followed by a small one, which ought to be retained.

We shall speak more fully of the varicose condition of the vaginal veins under the article *Thrombus of the Vulva.*

ARTICLE IV.

LESIONS OF THE SECRETIONS AND EXCRETIONS.

§ 1. Ptyalism.

Ptyalism, or a hypersecretion of saliva, sometimes occurs during pregnancy. It generally lasts but a short time, rarely more than two months. One case, however, is mentioned by M. Brachet, in which the salivation commenced in the second month, and lasted for a month after delivery; and I have quite recently observed a similar instance in the case of the wife of one of my professional brethren. It frequently returns in several successive pregnancies. I have seen it continue between six and seven weeks in the two first pregnancies of a lady who has since had another child without a recurrence of the affection; and M. Danyau, Jr., mentions a patient who was profusely salivated for five months in her first pregnancy, and still longer and more profusely in two succeeding gestations.

However considerable the salivation may be, it is rather a disagreeable inconvenience than a serious complication. Though it has in no case materially affected the health, some women have been so annoyed with the continual spitting, and the flow of saliva which sometimes deluges the pillow at night, as to insist upon being relieved of it. Happily, in a large proportion of cases, the ptyalism ceases spontaneously, for no great confidence can be reposed in the measures generally resorted to for its removal. Some advantage, however, may be derived from the use of aromatic infusions and slightly astringent gargles. Like Desormeaux, I have found it useful to recommend the patients constantly to keep a little piece of sugar-candy in the mouth. Others, again, advise lumps of gum arabic, and pieces of ice. It is useful to be acquainted with these various measures, if only to keep up the patience of the sufferer, by varying them from time to time until the disorder ceases of its own accord.

Some authors seem to have dreaded the effect of the sudden suppression of a profuse salivation. Two cases are mentioned, in one of which apoplexy

and in the other symptoms of suffocation, appeared to result from it. I do not think that the relation of cause and effect has been satisfactorily shown in these cases, and am tempted to believe that here, as in many other instances, it has been erroneously concluded, *post hoc, ergo propter hoc.*

§ 2. Excretion of the Urine.

The renal secretion is rarely increased during pregnancy; those writers who have stated the contrary, having been deceived by the frequent inclinations to urinate which females experience at certain periods of pregnancy. These repeated desires are due to a true vesical tenesmus, produced by the compression exerted upon the body and neck of the bladder by the uterine tumor. They occur every hour, sometimes oftener, and are relieved by the discharge of a few drops of urine.

The pressure of the uterus upon the neck of the bladder is sometimes so great as to obstruct the emission of urine, and render it painful or even impossible. This difficulty in urinating may occur in the commencement of pregnancy, either when the pelvis is too large, and permits the uterus to remain a long time in the excavation, or on the occurrence of a prolapsus uteri, or those other displacements of this organ known as anteversion and retroversion.

Most frequently, however, it appears towards the end of gestation, either because the uterus, from being pushed down by the presenting part of the fœtal head, early engages in the excavation, or because the womb is forcibly carried forwards; in the latter case the body of the bladder is pressed upwards and in front by the uterus, and its neck forced against the superior margin of the symphysis pubis.

When the anteversion is well marked, the body of the bladder forms an angle of the neck; in some cases it is even lower, whence the introduction of a catheter is then exceedingly troublesome. After all, the difficulty of urinating still persists until term, whatever we may do; for we can only alleviate it by tepid bathing, the horizontal position, and more particularly by the use of a bandage to sustain the abdomen.

Where the retention is complete, the bladder, by becoming distended, may increase so much in size as to reach the umbilicus, and its excessive distention might produce an inflammation or even a rupture, especially during the throes of labor; but where the neck is not altogether obliterated by the pressure, an incontinence of urine may ensue, the fluid dribbling away drop by drop; though, unfortunately, that is not always the case, and the catheter must then be resorted to.

I have already said this operation is attended by difficulties under such circumstances, and when it is quite impossible to perform it, the distress may be relieved, in a measure, by pressing back the uterus from the symphysis pubis with the two fingers introduced into the vagina, and the woman should be taught to aid herself in this way.

In some instances, the female suffers at the latter stages a considerable smarting or pain in urinating, as sharp as if there was a stone in the bladder; these symptoms arise from a true catarrh of the body, or at least of the neck of this organ; the urine, in fact, often contains whitish flakes of purulent matter. Such symptoms require the general antiphlogistic treat-

ment, local bathing, emollients, and mucilaginous drinks. As a general rule, women only suffer from an incontinence of urine during the last three months, and then the delivery is the only remedy; however, it shows itself in the early stages of gestation in certain females, being evidently produced by the pressure which the uterus, that is still within the pelvis, makes on the neck of the bladder, and it lasts until the womb rises above the superior strait. If the incontinence remains after the fifth month, the symptoms may be relieved by injections of warm water, and by the internal use of tonics.

Though the amount of urine is not changed, its composition sometimes undergoes alterations which it is important to be acquainted with.

I shall not return to the consideration of the peculiar pellicle called kyesteine by M. Nauche, and whose diagnostic value we have already determined; but I shall proceed to notice a very remarkable fact, which we shall often have occasion to refer to; I speak of the presence of albumen, which is found in greater or less amount in the urine of some women at an advanced stage of pregnancy. (See *Albuminuria.*)

§ 3. Albuminuria. Uræmia.

The credit of having called the attention of physicians to the presence of albumen in the urine of pregnant women belongs to M. Rayer, whose admirable and laborious investigations of the disease of the kidneys have thrown so much light upon the pathology of those organs. He was the first to endeavor, in his splendid work, to determine the effect of this alteration of the urinary secretion upon the health of the mother, and the regular development of the fœtus. Afterward, followed the observations of Dr. Lever and of Dr. Cahen, who, by the advice of his master, M. Rayer, published a good thesis upon the subject. Next came the interesting memoir of MM. Devilliers and Regnauld, and another thesis by M. Blot. More recently, two manuscript memoirs by MM. Imbert Goubeyre, and Bach, and the researches of Frerich, Schott, and Wieger, have shed some light upon this still obscure point of puerperal pathology.

It is known that albuminuria is generally the symptom of an organic disease of the kidneys, which almost always proves fatal; hence, it may be readily understood, that when this change in the urine is observed during pregnancy, it becomes at once desirable to ascertain whether it be necessarily due to the same cause, or whether it be merely one of the numerous modifications produced in the economy by gestation.

In the first case, it is a very serious affection, calculated to awaken all the solicitude of the physician; in the second, it is but a temporary functional disorder, which will most probably disappear with the cause that produced it. Unfortunately, in the present state of our knowledge, it is very difficult to decide the question. For, on the one hand, 1. The normal diminution of the albumen in the blood of pregnant women, which diminution is much greater in patients affected with albuminuria, since MM. Devilliers and Regnauld have observed it to descend to 56·39, would lead to the supposition that the cases under consideration were but exaggerations of what ordinarily occurs, and that the elimination of a larger amount of albumen than usual from the blood, be the cause what it may, accounts for

its evacuation by the urine. 2. The albuminuria of pregnancy is not generally accompanied by the functional disorders and the symptoms to which it gives rise when connected with disease of the kidneys; and the dropsy itself, which is almost constantly observed in the latter case, is sometimes wanting in pregnant women affected with albuminuria, as was twice observed by MM. Regnauld and Devilliers, as I have myself witnessed, and as M. Blot found to be the case twenty-three times out of forty-one. 3. Lastly, in the majority of instances, it disappears immediately upon the termination of the pregnancy which caused it; and when we consider the obstinacy of albuminous nephritis, it is difficult to account for this sudden disappearance of a disease, which, under other circumstances than the puerperal condition, so frequently has a fatal termination. On the other hand, however, observation shows that in almost all the cases in which women die of the convulsions which too frequently complicate albuminuria, the kidneys present the anatomical characteristics of albuminous nephritis, the more or less advanced degrees of alteration appearing to correspond with the duration of the disease and the amount of albumen discharged. Many times have I had occasion to observe this fact, and fearing lest I should interpret the alterations erroneously, have almost uniformly presented the kidneys to the examination of M. Rayer, who generally recognized in them the second, sometimes the third, and only once the fourth degree of alteration.

The learned physician of La Charité considers the more frequent occurrence of the anatomo-pathological characters of the second degree of the disease to be due solely to the recency of the latter, and by no means to a difference of nature. It is no less the consequence of a renal hyperæmia, which he supposes may be caused in many cases by compression of the emulgent veins by the enlarged uterus, and the consequent obstruction to the return of the venous blood. That, in simple cases, it generally disappears promptly after delivery, is probably due to the consequent cessation of the congestion of the kidney which was maintained by the pregnancy.

We see, therefore, that the question is far from being settled; whilst M. Blot, for example, regards puerperal albuminuria as generally unconnected with Bright's disease, M. Bach, of Strasbourg (Memoir, crowned by the Academy), thinks that it is only *sometimes* due to albuminous nephritis, and M. Imbert Goubeyre (Memoir, crowned by the Academy) endeavors to prove that it is always a sign of Bright's disease. Now, is it impossible to throw a little light upon this question, which is still so obscure?

Healthy urine contains no albumen, and the same is true for the healthy woman in the puerperal condition. Albuminuria, therefore, always indicates a pathological condition of which it is the symptom; for every functional disorder, whether temporary or persistent, supposes a momentary or prolonged alteration of the organs whose office it is to accomplish the function. Therefore, the investigation of the causes of albuminuria implies that of the general or local affections which are capable of producing it. But lest we should go astray in these researches, it is very important to ascertain *a priori*, what are the organs upon which the accomplishment of the urinary secretion devolves. The kidney is supposed to be exclusively

intrusted with this office, and thus it happens that the material explanation of all the disorders of the secretion is sought for in lesions of that organ. Now, as M. Pidoux has very judiciously observed, the secretion of urine is not confined to the kidney, since it takes place previous to the formation of the latter. (Uric acid and the other elements of the urine have been discovered in the fluid contained within the allantoid.) The process of assimilation, which is so active in the fœtus, can only be understood by supposing a contemporaneous process of decomposition. The blood which flows to the organ is already charged with the elements of urine which are to be separated from it in the passage. The function begins in all parts of the economy by this admixture of heterogeneous elements with the blood, and is completed in the kidney by their elimination from the circulating fluid, which is returned in a purified condition. M. Pidoux was therefore right in saying, that the secretion of urine is at once a local and general function: general, because it commences everywhere, and local, because it ends in the kidney. To study the latter organ exclusively, when we wish to obtain a physiological idea of the function, is to neglect an important element; so, also, in pathology, always to expect to find the cause of the disorders of the urinary secretion in alterations of the kidney, is to overlook a multitude of other causes which may have a corresponding influence. The elements of the blood conveyed by the renal artery exist, in health, in a fixed proportion, and certain of them are destined to be eliminated by the kidneys. Now it is easy to understand that if an alteration in the structure of these organs is capable of modifying both the quantity and quality of the matters eliminated, an alteration of the fluid, such, for example, as the diminution or increase of its solid or fluid parts, may also have the same effect. Clinical observation and post-mortem examination give constant support to this idea; for though we sometimes find a material lesion of the kidney to which we attribute the albuminuria, we are very frequently obliged to recognize the fact that it is very often absent.

[In the present state of knowledge in respect to albuminuria it cannot be regarded as the symptom of any one single lesion, the passage of albumen being due to many different causes upon the nature of which great light has been thrown by physiological experiment. The most striking experiment is that of Claude Bernard, who, having injected a solution of the white of an egg into the veins of an animal, found that albumen soon made its appearance in the urine. The same result followed the injection of serum of blood. Albuminuria may also be produced artificially by feeding animals with albuminous matters exclusively. All these experiments prove that an excess of albumen in the blood is always followed by albuminuria. A somewhat similar excess is found in the blood of pregnant women, for, we have here to consider not the relative proportions of the water and organic matters, but rather the comparative relations of the two. Now Mr. Gubler states that such a comparison shows, as a general rule, a marked predominance of albumen as compared with the corpuscles (see page 158). He therefore regards the proportionate superalbuminosis of the blood as the common determining cause of albuminuria. During pregnancy, continues this author, the mother's blood has to supply the fœtus with its nutritive materials, but only in a soluble and diffusible form, inasmuch as no inosculation exists between the maternal and fœtal vessels. Albumen in its various forms is, therefore, required for the nourishment of the new being, and whilst this is the case the maternal organism has to provide for a double expenditure

In consequence either of an increased ingestion or a more perfect appropriation of protein substances, or to both causes conjoined, a greater amount of albuminous matter is continually supplied. Now, under the changes impressed upon the functions, a bad state of the economy or the perturbations produced by the first efforts, so to speak, in this novel direction, may cause the albumen to accumulate in proportions beyond the needs of the two conjoined organisms.

In this view, the albuminuria of pregnancy implies an excessive production of albuminous matters in relation to the requirements of both mother and child. Sometimes it will be that the former produces too much, and sometimes that the latter appropriates too little; again, both these conditions may concur to produce the same result. Should the children, when born, be of the usual size and weight, it would be fair to conclude that the albuminuria resulted from disorder of the maternal economy; should they, however, be small and puny, it would be equally just to suppose that their condition may have caused the excess of albumen in the blood and its consequent filtration through the kidneys. We would add, as a fact shown by experience, that children born of mothers affected with albuminuria are often of less than the medium weight and development. The remarks of Danyau, Depaul, and Blot put the truth of the latter statement beyond a doubt. (Gubler.)

In connection with the superalbuminosis just discoursed of, we should consider the effect of the pressure of the blood upon the walls of the vessels as of no less importance in the etiology of the affection. If enough water be thrown into the vascular system to increase suddenly the mass of the blood and produce a strong vascular tension, albumen is found to escape immediately by the urine. A still more decisive experiment is afforded by ligating the emulgent vein. In this case, the sudden arrest of the venous circulation determines a progressive stagnation in the capillary vessels and albuminuria results. The same result is obtained if the ligature be gradually tightened, so that entire interruption of the flow of venous blood is not produced for several hours or even days. Whenever, therefore, sufficient pressure is made by a tumor upon the renal vein or vena cava inferior to slacken and obstruct the returning circulation in the kidney, the urine is liable to contain albumen. This, M. Jaccoud states, is the most frequent cause of the albuminuria of pregnancy. Generally, indeed, it does not begin until after the sixth month of gestation (Rosenstein, Braun), but then everything conspires to produce considerable obstruction of the abdominal circulation; that of the kidney is slackened as well as that of the liver or spleen (Virchow), and the pressure thus abnormally produced in the malpighian bodies leads to the passage of albumen into the urine. This view, now universally received (Frerichs, Braun, Rosenstein, Wieger, Beckmann, Krassnig, Brown-Seguard), is evidently not applicable to that kind of albuminuria which appears exceptionally during the four last months of pregnancy. At this period it can no longer be attributed to obstructed circulation in the renal veins, the pathological process being entirely different. (Jaccoud.)

Superalbuminosis, therefore, on the one hand, and great distention of the vessels of the kidneys on the other, afford a satisfactory explanation of the albuminuria of pregnancy; but are we to conclude that the kidneys themselves have nothing to do with the causation of the disease? Evidently not, for the albumen would remain imprisoned in the blood-vessels indefinitely, did not the kidney undergo such changes as would allow the protein matters to pass through it, that is to say, did it not become affected with active congestion and certain transient parenchymatous alterations which are the instrumental conditions of the disease. Co-operative circumstances, such as the impression of cold, might increase the hyperæmia to the state of inflammation properly so called, and thus give rise to what Gubler has termed *secondary albuminous nephritis*. In this case, the albuminuria is maintained by the kidney itself.

But this is not all. The kidney may also be the seat of the initial phenomena of the disease; which would then be due to a *primitive albuminous nephritis.*

To recapitulate: the albuminuria of pregnancy is produced by various causes, the principal of which, in our opinion, seem to proceed from and be connected with the three following conditions:

1. Superalbuminosis.
2. Over-distention of the blood-vessels of the kidneys.
3. Albuminous nephritis, which may be either primary or secondary.]

This succession of pathological phenomena seems to me to throw much light upon the etiology and nature of puerperal albuminuria, and to reconcile apparently contradictory facts and opinions. It were certainly going too far to say that all cases of albuminuria during pregnancy are attended with albuminous nephritis; it is an opposite exaggeration, on the other hand, to insist that there very rarely exists a connection between the albuminous urine and the disease described by Bright. The true statement, we think, would be: that pregnancy generally produces a notable change in the relative proportion of the elements of the blood, which change consists essentially in a diminution of the solid constituents, with relative predominance of albumen.

This general alteration is of itself capable of producing the elimination of albumen; but when existing in a slight degree only, and therefore unequal to the production of albuminuria, may have its action assisted by the active or passive congestions to which the kidney may be exposed during pregnancy, and especially during labor. Those simple hyperæmias of the kidney, which are so often seen after death, and which are really the first degree of granular nephritis, do not appear to have any other cause.

The marked influence which a first pregnancy appears to have in the production of albuminuria (the resistance of the walls of the abdomen increase greatly the pressure sustained by the parts situated behind the uterus) is thus explained, as also the rapidity with which the albumen frequently disappears after labor.

[According to most authors, the presence of albumen in the urine is almost always coincident with diminution of urea, which would even seem to lessen in quantity in proportion to the abundance of urine. The urea being imperfectly eliminated by the kidneys, therefore accumulates in the blood. For further discussion of this subject, see *Uræmia*, at the end of this article.

Let us now examine the methods of detecting the presence of albumen in the urine and the symptomatic troubles to which its existence there gives rise.

Notwithstanding all that has been said respecting the appearance of albuminous urine, its want of color, and the frothy bubbles which form on its surface, it would often pass undetected if care were not taken to examine it closely by peculiar processes. Many chemical reagents have been proposed for its analysis, but heat and nitric acid are almost the only ones to be relied on.

The simplest process for detecting albumen is as follows: having drawn the urine by a catheter in order to avoid the inconvenience of admixture with vaginal or lochial discharges, it should be poured into a tube and heated to the boiling-point. When ebullition commences, should the urine be albuminous, it grows cloudy, and a flocculent coagulum precipitates. It ought, however, to be understood that this coagulum is not a certain indication of albumen, since alkaline urine might precipitate its earthy salts. An opposite error might also occur, inasmuch as highly

alkaline and at the same time notably albuminous urine contains but a small proportion of earthy salts and is not clouded by heat. In all cases, therefore, it is indispensably necessary first to test the urine by litmus-paper, and if alkaline to acidulate it with a small quantity of nitric acid; after which it should be subjected to boiling.

The testing by heat is liable to another objection, to wit, that urine which is albuminous but at the same time very acid, may not yield a precipitate by heat. The resistance to coagulation depends, in this case, according to Gubler, upon the presence of phosphoric acid. Here a little nitric acid, by neutralizing the influence of the phosphoric acid, restores to the albumen the power of coagulation by heat. On the other hand, a still larger proportion of acid would precipitate the albumen directly, without the assistance of an elevated temperature.

Instead of having recourse to heat, albumen may be sought for in urine by allowing a few drops of nitric acid to flow down the sides of the glass containing the fluid. The acid coagulates the albumen and a flocculent precipitate soon forms.

This method, unfortunately, is not decisive, for the action of nitric acid upon cold and acid urine gives a precipitate of uric acid resembling considerably that of albumen. We may avoid deception, however, by warming the clouded fluid, which will resume its transparency as the temperature rises in consequence of the greater solubility of uric acid at high than at low temperatures.

All the preceding considerations show: 1st, that albumen may be supposed to exist when it is absent; 2d, that it may be overlooked when present. The testing for albumen is not so easy as is generally supposed. Therefore, it were better, for greater certainty, to examine first by boiling and then by nitric acid. All the difficulties presented by the analysis have been thoroughly stated by Gubler (*Dictionnaire Encyclopédique*), whose work we refer to without being able to enter at present into greater detail.]

The urine, in Bright's disease, presents other alterations besides its admixture with a certain proportion of albumen. Thus, when submitted to microscopic examination at a certain period of the disease, it is found to contain mucous corpuscles, scales of epithelium derived from the bladder, ureters, and pelvis of the kidney, besides elongated cylindrical bodies formed of amorphous fibrin, in the substance of which blood-corpuscles may be observed, either singly or in groups. These have been termed fibrinous cylinders, and are regarded by Frerich as pathognomonic of Bright's disease.

According to some authors, all these peculiarities are observable in the urine of pregnant women affected with albuminuria; according to others, on the contrary, the fibrinous cylinders are very rare in the latter case, and M. Blot has quite recently examined the urine of three eclamptic patients without discovering them.

I am not prepared to decide upon this point, though it seems to me very probable that this difference of results is simply due to the fact that, in the first case, the kidneys were diseased, whilst in the second the recent albuminuria was connected only with a general alteration of the fluids.

After the indications afforded by examination of the urine, the next most frequent symptom of albuminuria is general infiltration or anasarca, which must not be confounded with bedema of the lower extremities. (See *Dropsy of the Cellular Tissue.*) The latter is occasioned simply by the mechanical obstruction of the venous circulation produced by the pressure of the gravid uterus.

General infiltration is not so uniform an accompaniment of albuminuria as I thought formerly. In order to determine its relative frequency, it is necessary not only to examine the urine of infiltrated females, as was my practice, but to investigate carefully the urine of all pregnant women, as was done by M. Blot. It will then be discovered that many patients with albuminuria present not a trace of œdema. M. Blot found it, we have said, in 23 cases out of 41.

It is proper to observe, that this absence of infiltration is also often noticed in the ordinary Bright's disease. By a collection of observations with autopsies, derived from various authors, Frerich found that, of 220 cases of Bright's disease, 175 were accompanied with œdema, and 45 were free from it.

Nervous disorders are sometimes attendant upon the anasarca.

In the last edition of this work we stated that puerperal albuminuria did not usually give rise to the symptoms which accompany Bright's disease. This is true for the light cases, which, happily, are the most frequent; but science has progressed, and modern researches have proved that certain of the affections of the pregnant female, whose cause and nature were entirely unknown, coincide with albuminuria, and very probably are, like it, the consequence of extensive elimination of albumen from the blood. Thus, in several cases of amaurosis occurring during pregnancy, MM. Simpson, Imbert Goubeyre, and others, have detected albumen in the urine. The same is true of certain cases of obstinate headache, of lumbar pains and pleurodynia, of paralysis (hemiplegia or paraplegia), (Robert Johns, Simpson, Imbert Goubeyre), and of contractions, hemorrhages (Blot), &c. (See *Uræmia*, and *Paralysis.*)

Now, M. Imbert Goubeyre's remark is very important, namely, that all these phenomena are found in the symptomatology of Bright s disease, which confirms the comparison that we have made.

To the symptoms just mentioned we might add eclamptic convulsions, which are, happily, quite rare, and hardly ever appear, except at an advanced stage of the disease. We shall treat of them at length hereafter. (See *Uræmia*, and *Eclampsia.*)

It is very difficult, not to say impossible, to determine with certainty when the albuminuria commences; to do this, it would be necessary to examine daily the urine of a large number of women during the entire period of pregnancy. Hitherto, it has generally been observed only during the latter months. M. Bach, of Strasbourg, however, says that he has seen it at six weeks in a very nervous person. I once detected it at four months in a greatly infiltrated primiparous female, who was delivered at six months of a still-born child, and whose urine was slightly albuminous eighteen months afterwards, although the infiltration had disappeared since six months. M. Cahen mentions in his thesis three cases, recorded in the fifth and sixth months, and M. Bach two others. Perhaps, now that attention is directed to this point, such facts will multiply; but those observed hitherto have almost always been noticed in the latter stages. Sometimes it appears only at the moment of delivery, under the influence of the parturient efforts, which are well calculated to produce congestion of the kidneys.

When once begun, the progress of albuminuria is liable to great variation; sometimes it continues uninterruptedly until the commencement of labor, and increases during its continuance; at others, it varies greatly in intensity, and may even cease completely for several days, then reappear, and again stop at very indefinite intervals.

When it begins during labor or shortly before, it often disappears a few hours or days after delivery; but it follows from the facts collected by M. Imbert Goubeyre, that so prompt a cessation is not as common as I had thought, and as M. Blot had stated. Though there are cases, says M. Imbert Goubeyre (memoir quoted), in which the albumen disappears with rapidity, in others it continues, and passes into chronic and confirmed Bright's disease. From a statement by this author, it appears that, of 65 cases of puerperal albuminuria unaccompanied with eclampsia, 21 proved fatal during pregnancy and the lying-in; and 6 from the third to the fourteenth month after delivery; 5 cases became chronic, and were found to be still existent, two, eight, ten, and fourteen months, and seven years after the labor.

I but just now mentioned a case in which albumen was detected in the urine eighteen months after delivery.

These differences appear to me to be due to the greater or less intensity of the disease. When the alteration of the fluids is but slight, especially when it has existed for but a short time, and occurs towards the end of gestation, or only during the labor; when, finally, the active or passive congestion of the kidneys, produced by obstruction of the venous circulation, has had its influence in causing the albuminuria, we can understand how the removal of one of the causes, by delivery, may leave the other incapable of sustaining the functional disorder. But when the alteration is slight, especially when it dates back to the middle or first half of the pregnancy, it may then continue for a long time after delivery. In these latter cases, granular nephritis is often present; but I am much inclined to believe that sometimes the kidney is unchanged, or very slightly altered, notwithstanding the persistence of the albuminuria.

In respect to the prognosis, the coexistence of an alteration of the kidney is of the highest importance; unfortunately, however, the diagnosis during life of this organic lesion is extremely difficult, inasmuch as none of its symptoms are pathognomonic. It would appear, however, from the researches of M. Pickard (thesis, Strasbourg, 1856), that great light may be thrown upon the question by analysis of the blood, since, when the kidneys are diseased, the blood contains an amount of urea much greater than in any other cases of albuminuria; moreover, the quantity of urea is proportionate to the greater or less advanced degree of renal alteration, a very small proportion of urea in the blood generally coinciding with simple congestion of the kidneys.

Has the albuminuria any effect upon the progress of the pregnancy, and upon the life and development of the fœtus? M. Blot thinks that it has not, whilst MM. Cahen, Rayer, and some others, hold the contrary opinion.

I still regard the view of M. Blot as entirely correct for the slight cases, which are, I repeat, the most common; but it does not appear to me well

founded as regards those complicated with anasarca, or which begin before the latter half of gestation. I am very much inclined to consider it as being then a frequent cause of abortion, of premature labor, and of death to the fœtus.

We have noticed the views of Simpson and others respecting the frequent occurrence of albuminuria in numerous puerperal disorders. M. Blot considers it a cause of hemorrhage. It is, therefore, as relates to the prognosis, a sign which is always calculated to excite solicitude. As a diagnostic sign it is certainly destined to reveal the nature and etiology of a multitude of affections hitherto of very difficult explanation; therefore, it is now indispensable, in obscure cases, to examine carefully the urine of pregnant women, even when unattended with dropsy. It may possibly be shown in the future that albuminuria is a central point towards which converge a multitude of diseases of various characters, and these researches may throw light upon their treatment, which is still so obscure.

If we have succeeded in showing that an altered state of the blood is the principal cause of puerperal albuminuria, and that this alteration consists chiefly in a diminution of its solid constituents, we shall have no occasion to insist strongly upon the advantages of a reparatory treatment. Unless very evident symptoms of general plethora or renal congestion be present, bleeding would be rather hurtful than useful, in a disease attended with so great impoverishment of the system; therefore a tonic medication should be resorted to from the outset. A good animal diet, assisted by the use of whatever ferruginous preparation will be most readily supported by the patient, ought evidently to form the basis of the treatment. The preparations of Peruvian bark, and other bitters, may be added with advantage.

[*Uræmia.*— We have just said that albuminuria is often accompanied by various nervous disorders (amaurosis, paralysis, eclampsia), the production of which it is very difficult to explain satisfactorily. It will not, however, be forgotten that albuminous urine contains but little urea (see page 494), which being no longer eliminated by the kidneys, must necessarily accumulate in the blood. This fact is supposed to account for the nervous disorders in question, by giving rise to a peculiar poisoning to which the name uræmia is applied. We propose now to state the principal points and successive phases of the doctrine of uræmia, premising, however, that it is liable to numerous objections.

Wilson first, and afterwards Rayer, attributed the nervous complications of albuminuria to the presence of urea in the blood. At first accepted without limitation, this opinion was soon attacked in its very foundation. Cases were cited in which urea was present in large amount in human blood without being attended by any of the so-called uræmic symptoms. Finally, Cl. Bernard, from experiments made by injecting urea into the blood of animals, came to the conclusion that urea is incapable of producing the nervous accidents of albuminuria. Thus Wilson's theory was ruined.

Frerichs came, for a while, to the rescue of the doctrine of uræmia by explaining the facts differently. According to him, urea is, of itself, innocuous, the danger arising from the fact that it is easily decomposed in the blood, giving rise to carbonate of ammonia, which really is poisonous. Frerichs' experiments appeared to be decisive. He injected carbonate of ammonia into the veins of dogs in good health, and after a very short time the expired air contained carbonate of ammonia, and the animals were soon taken with convulsions and coma. The symptoms thus

artificially produced bore a strong resemblance to eclampsia, and Frerichs' position seemed for a time to be thoroughly established. It was thus presented in a favorable light in former editions of this work, but since then it has lost ground and its partisans become daily less numerous. The fact is, that the theory is not free from objections; and out of a great number of experiments which go to contravene those of Frerichs, I again cite the opinion of Bernard, which is far from being favorable. This celebrated physiologist asserts that carbonate of ammonia is almost always present in human blood, whether in health or in disease, and the experiments which he undertook satisfied him, moreover, that it is far from being productive of the terrible nervous symptoms which have been attributed to it. "If," says the learned professor, "carbonate of ammonia be injected in small quantity, it produces no effect. When thrown in larger amount into the blood of a dog, the animal cried and was extremely agitated for a considerable time: nevertheless it recovered." From these experiments Bernard concludes that eclampsia cannot be explained by carbonate of ammonia. The same opinion is given in the excellent thesis for the Concours, of my colleague Dr. Fournier; and, for my own part, I would say with him that Frerichs' doctrine, ingenious and learned though it be, will not bear severe scrutiny. (Fournier, *Thèse de Concours pour l'Agrégation*, 1863.)

At present, the position can no longer be sustained that uræmic symptoms are due to the presence in the blood of any single principle, whether urea or carbonate of ammonia. Schottin assumes that substances imperfectly known as yet, and vaguely styled *extractive matters*, may accompany the urea, remain in the blood, and give rise to a poisoning which Gubler proposed to call *urinæmia*. This last mode of interpreting the facts is an approximation, perhaps, to the truth, though it is far from proven that it represents it precisely.

"If the doctrine of uræmia or of urinæmia be accepted as true, how shall the nervous troubles which it produces be explained? Here come in what have been termed the nervous theories of uræmia. Certain authors, as Traube and Sée, regard the nervous phenomena of uræmia as somewhat analogous, as respects the intrinsic mode of production, with the pathogenic process which Kusmans, Tenner, and others assign to epilepsy. Through some change in the blood an excitement is produced of the vaso-motor nerves and the cerebral arteries. These arteries contract, and there result either oligæmia of the medulla oblongata giving rise to convulsions, or the same condition of the encephalon giving rise to coma." (Fournier, *Thèse de Concours*.)

In short, the clinical facts are real, and all physicians have occasion to see how frequently nervous troubles arise in the course of an attack of albuminuria. How shall they be explained? Though the question seem at present to be unanswerable, I have deemed it my duty to exhibit the present state of knowledge on the subject. Should the doctrine of uræmia be false and that of urinæmia doubtful, plausible hypotheses would still remain whereby to explain the nervous disorders complicating albuminuria. Other changes in the blood, altered nutrition of the nervous tissue (Gubler), hyperæmia or anæmia of the encephalon, serous effusions upon the surface of or in the cavities of the brain (Rilliet, Natalis Guillot), and œdema of the cerebral substance, are all circumstances capable of explaining the convulsive phenomena and concomitant symptoms observed in certain forms of albuminuria. (Gubler.)

One other difficulty remains to be mentioned. What are the nervous disorders observed in cases of albuminuria? In the first place we would mention cephalalgia, troubled vision and hearing, vomiting, coma and eclampsia. Up to this point there is no disagreement. But are cases of paralysis like hemiplegia or paraplegia ever witnessed? Here is a case of controversy: Churchill and Imbert Goubeyre on the one hand, admit that puerperal paralyses are not uncommon, whilst on the other

almost all pathologists, Addison, Sée, Lasègue, Fournier, and Grisolle, remark that paralysis has no place amongst the nervous disorders of albuminuria. When hereafter we come to study puerperal paralysis and include uræmia in their etiology, we shall not lose sight of the difference of opinion upon this subject.

In short, various nervous affections occur in women affected with albuminuria, to explain which the doctrine of uræmia and urinæmia has been invoked, although confidence in it has become very much shaken. All our knowledge on the subject is hypothetical, and further investigation is indispensable to reduce it to any certainty; therefore, whenever we shall mention uræmia in explanation of any pathological condition, our reservation on the matter will be brought to recollection.]

§ 4. Dropsy of the Cellular Tissue.

Another affection of quite frequent occurrence, and one which is often connected with what accoucheurs call plethora, of which, according to Chaussier, it is a variety (serous plethora), is serous infiltration of the cellular tissue. This infiltration begins in the feet, then extends to the legs, thighs, genital parts, and sometimes rising above the lower extremities, invades the trunk, face, upper extremities, and is sometimes even accompanied by effusion into the great serous cavities.

These dropsies, upon which MM. Devilliers and Regnauld have published an interesting memoir, are by them divided into: 1, simple œdemas; 2, œdemas connected with affection of the central organs of respiration and circulation; 3, œdemas with albuminuria.

The œdema connected with lesions of the organs of circulation generally increases during pregnancy, but this increase is especially due to the unfortunate influence which gestation has upon all organic lesions, and we have no occasion to speak of it further. As regards the two other species, we think it proper, in order to avoid repetition, to include them in the same description; for though they have some special characters upon which we shall have to insist, they resemble each other in a great many particulars.

The *causes* of the serous infiltrations which occur during pregnancy, may be divided into general and local. As first in importance of the general causes, we must rank the decrease in the proportion of albumen; a decrease which has been discovered by all observers in the blood of pregnant women. According to M. Andral, this special alteration of the blood is the only one which necessarily produces dropsy. The amount of effusion is dependent upon the extent of the alteration, which, if considerable, is often attended with albuminuria.

Hydræmia, or serous plethora, which also produces œdema in certain chlorotic patients, may also give rise to the same symptom during pregnancy, and assist in the production of serous infiltrations. When these general alterations of the economy are but slight, they usually would be unequal to the production of œdema, did not the development of the womb add its local action to their own.

The pressure of the womb upon the surrounding parts from early pregnancy, and the obstruction which it occasions to the performance of the functions of the central organs of respiration and circulation at an advanced stage, when by rising into the epigastric region it forces up the diaphragm and thus diminishes the thoracic cavity, explain why the œdema commences

in the lower extremities, and why it generally does not extend until a much later period to the trunk and upper extremities.

Progress and Symptoms.—Generally speaking, the œdema makes its appearance within the last three months of pregnancy, especially when it appears to be due simply to a mechanical obstruction of the circulation. But when it results from one of the general causes before mentioned, it may commence with the pregnancy, or in the third or fourth month. However, as hydræmia, the diminution of the albumen of the blood, and the albuminuria, are most generally observed in the latter half of gestation, we may understand that the dropsy to which they give rise should also be more common towards the seventh, eighth, or ninth month.

The progress of the œdema of pregnancy is generally slow and chronic; sometimes, however, it advances rapidly in a few weeks. Whatever may be the case in this respect, it generally begins by the lower extremities; sometimes affecting one of them, at others both. At first it is limited to the feet and neighborhood of the ankles; sometimes even it never gets farther than the lower part of the legs, though quite frequently it reaches the knees, the thighs, and external genital parts. Occasionally it invades the integuments of the lower part of the trunk, and in some rare cases, generally attended with albuminuria, it affects even the face and hands.

In the early stages, while limited to the lower part of the legs, it disappears at night, in consequence of the horizontal position, and is only well marked towards the close of the day. But when the disease has advanced farther it continues, whatever position the patient assumes; and although the horizontal posture seems to diminish the swelling of the legs, it it only because the infiltrated fluid is displaced to the lower part of the trunk.

The amount of fluid extravasated varies between a slight puffiness and the extreme swelling which makes standing and walking impossible. In the latter case, the parts affected are generally the seat of pain, of sensations of pricking, and sometimes of burning and extreme tension.

The œdema rarely disappears before delivery; on the contrary, it generally increases until near the end of pregnancy. Sometimes, however, as MM. Devilliers and Regnauld have indicated, it undergoes remarkable variations. Thus, it may disappear entirely and finally, or it may return shortly after; sometimes it is observed to leave one member and fix upon the other, which had been but partially affected. These changes are doubtless owing to mechanical causes, the action of which varies or ceases with alterations in the situation of the uterus (Devilliers and Regnauld); but they certainly may also be occasioned by fluctuations in the albuminuria, which may be suspended for a short time and then reappear, as I have witnessed in one case after labor.

Terminations.—The dropsy of pregnant women, however caused, generally disappears quickly after labor; and in cases of albuminuria, the secretion of albumen often ceases with equal rapidity.

Prognosis.—If the dropsy be viewed as a simple fact, independent of the complications which so often attend and follow it, it assumes the position of a merely troublesome affection; but to appreciate the prognosis rightly, it is important to remember that some authors regard the œdema as favoring

abortion and premature labor. They also suppose it to be almost uniformly connected with the etiology of eclampsia, and often with the development of puerperal fevers; and finally, that sometimes the disappearance of the effusion after delivery has been followed by a frequently fatal serous congestion of the nervous centres or respiratory organs. The facts related by M. Lasserre leave no doubt in my mind of the truth of the latter proposition. It is especially important to bear in mind, that although these dangerous complications are possible as a consequence of simple œdema, they have been chiefly observed in cases of albuminuria with infiltration, and consequently that the presence of albumen in the urine adds greatly to the gravity of the prognosis. Hence the interest which then attaches to the examination of the urine.

The *treatment* of the dropsy of pregnant females should be conducted with the double purpose of overcoming the organic cause which so frequently produces the œdema, and to stimulate the absorption of the effused fluids. The preparations of iron and a tonic regimen appear to me to be especially called for in a disease which is so frequently connected with hydræmia. The presence of albumen in considerable quantity, even supposing it due to a nephritis, does not contraindicate this treatment. The antiphlogistics recommended by some authors seem to me likely to be more hurtful than useful; and unless the patient suffers very severe lumbar pains, or to the general infiltration are superadded dyspnœa, palpitations, extreme giddiness, and especially evident indications of uterine congestion, threatening abortion, I should think it right to prescribe bleeding. Even under the latter circumstances, I would employ it less as an antiphlogistic than as a revulsive, nor would I discontinue the use of the iron.

To assist the absorption of the effused fluids, mild laxatives, diuretics, and dry frictions may be used. To these may be added vapor-baths, provided the patient is able to bear them without danger of cerebral congestion.

If the distention and size of the lower extremities is so great as to make walking impossible and cause great suffering, and if the genital parts are greatly swollen, their disengorgement may be facilitated by practising small incisions, or, at least, a number of punctures, with the lancet or a needle. In several cases I have derived benefit from keeping compresses, saturated with cold water, applied to the limbs for several days. Levret advises blisters between the thighs and external labia, aided by slight punctures on the feet; but inasmuch as the application of blisters upon a highly œdematous limb is sometimes attended with serious consequences, I think it prudent to abstain from them.

§ 5. Ascites.

We have already stated, that dropsy during pregnancy was so far from being limited to the subcutaneous cellular tissue, that collections of fluid of variable amount might take place in the great cavities of the body. The effusion within the abdomen may occupy different locations: thus, it may accumulate within the amnion, and constitute dropsy of the amnion; or between the membranes of the ovum and the internal surface of the womb, in which case it furnishes the fluid that gives rise to hydrorrhœa; finally, by collecting within the cavity of the peritoneum, it forms a true ascites.

Either of these varieties of dropsy may occur separately, or two of them may coexist in the same female, as is often the case with ascites and hydramnion. We shall treat first of ascites.

This affection sometimes makes its appearance in the first half of the pregnancy, though usually towards the fifth or sixth month, rarely later. When the accumulation begins very early, it sometimes progresses so rapidly that the abdomen is larger at the fifth month than at the usual term of gestation, and as the infiltration of the lower extremities generally keeps pace with the effusion in the abdomen, the patients find it impossible either to walk or pursue their occupations.

The progress of the ascites increases rapidly; the face is puffed and livid; the abdominal walls, much thickened by infiltration, add to the size of the belly; the skin covering them, although distended and shining, sometimes has a tuberculous appearance, as in elephantiasis. The umbilicus usually forms a smooth, rounded, translucent tumor, of the shape and size of a hen's egg, at the base of which the umbilical ring may be felt, though it is too much distended to produce any circular constriction.

The greater labia share in the general infiltration, are enormously swollen, and affected with a painful irritation, produced by their constant friction against each other, and contact with the urine.

The skin of the lower extremities is so distended as to seem ready to burst at several points, and is exceedingly painful.

The progressive accumulation of fluid in the cavity of the peritoneum soon obstructs the regular performance of the thoracic functions; the dyspnœa becomes extreme, the respiration very short, wheezing, and painful; the patient is obliged to remain seated night and day; yet, notwithstanding this position, the hæmatosis is so imperfect that she seems threatened with suffocation at every instant, and has frequent attacks of faintness. The suffering condition is aggravated by almost constant insomnia, intense headache, extreme thirst, and disgust for food.

Percussion of the abdomen detects readily the presence of a large amount of fluid in its cavity, though the fluctuation is not equal in all parts of it. As Scarpa remarks, it is slight or absent in the hypogastrium and towards the flanks, is manifest near the hypochondriac regions, and very well marked in the left hypochondrium, near the edges of the cartilages of the false ribs.

The enormous distention of the parietes of the abdomen frequently prevents the uterus from being felt, and its elevation determined with precision. The motions of the child, though generally obscure, are, however, still perceived by the mother.

The prognosis of ascites complicating pregnancy is grave in proportion as it dates farther from the term of gestation. When it appears only in the latter months, there is every reason to hope that, notwithstanding its rapid progress, it will be arrested by delivery, before producing such disorders as seriously to compromise the life of the mother, and that, as in the observation of M. Prestat, the recency of the effusion will render its absorption easy after delivery. But when the ascites begins within the first half of the pregnancy, there is great cause for fear, should it progress rapidly, lest paracentesis should be demanded long before the ninth month. It were useless to

add, that the prognosis will be far graver, if, as unfortunately very often happens, the ascites should coexist with dropsy of the amnion. If, says Scarpa, there should fortunately be no uterine dropsy, the paracentesis may allow the pregnancy to progress favorably through its usual stages; but, under the opposite circumstances, it almost always happens that the womb, being excited by sympathy, contracts, and delivery follows.

Treatment.—The general bleeding, purgatives, and diuretics, employed with the design of retarding the advancement of the disease, have not seemed to influence its later progress, and it is conceivable that a too long-continued use of them might be prejudicial to the pregnancy. They should, therefore, be resorted to with the greatest reserve, and relinquished as soon as found to be unsuccessful.

When the disease has increased to such an extent as to threaten the life of the patient, it is evident that the only resource consists in the evacuation of the fluid. But where should the puncture be made?

The development of the uterus makes it impossible to insert the trocar at the place of selection in ordinary ascites. From the circumstance of the fluctuation being particularly well marked in the left hypochondrium, the prominence of which was greatest near the edge of the false ribs, Scarpa introduced his instrument between the uppermost part of the external border of the rectus muscle and the edge of the false ribs in the left hypochondrium. The patient aborted two days after, and recovered.

George Langstaff made an incision two inches above the umbilicus, exposed the peritoneum, and punctured it with a medium-sized trocar, being careful to introduce it but a short distance so as not to wound the uterus. He had thus given issue to about ten pints of fluid, when the womb came in contact with the end of the canula, interrupting the flow, and occasioning so much pain as to oblige him to withdraw the instrument. As the patient was unable to endure any pressure, he introduced a medium-sized gum-elastic catheter by the opening, directing it between the peritoneum and the anterior surface of the uterus. *Peritonitis followed eight hours after the operation;* three days subsequently to the operation she aborted, and three weeks later she was well.

Finally, in a case in which a considerable tumor existed at the umbilicus, Ollivier, of Angers, was decided by the tension and thinness of the skin at the part to make use of the lancet simply. This instrument was introduced in the same manner and to the same depth, as for bleeding, at the middle and front part of the tumor, at the distance of half an inch from the circumference of the ring. The water flowed immediately to the amount of sixteen pounds.

For twelve days, the serum continued to flow by the little wound, which was closed hermetically on the thirteenth. The patient, who had been relieved at once, experienced a return of the accidents with the fresh accumulation of fluid. Twenty-eight days after the first puncture, it became necessary to repeat it; eight pounds of fluid were discharged, and the same alleviation followed. Twelve days after this, the woman was delivered of a living, though feeble child, and in fifteen days was discharged cured.

This simple process, consisting of a small puncture with the lancet, seems

to me preferable to Scarpa's operation in the hypogastrium. The latter might, in some cases, endanger important organs, and could only be preferred on account of the existence of an old umbilical hernia with adhesions of the intestines to the sac. The presence of this complication can be readily discovered by holding a candle behind the thin and transparent walls of the umbilical tumor, as for the diagnosis of hydrocele, when the opacity of the exomphalos will be at once detected.

There is no advantage in placing a foreign body in the small opening, since the flow of serum keeps the sides separated, and the density and extreme thinness of the walls of the tumor prevent infiltration of the abdominal parietes. The observation of Langstaff, above cited, as also another fact related by M. Danyau, prove that the introduction of a foreign body exposes to peritonitis.

When the pregnancy has made but slight progress, the only resource evidently consists in the puncture; but when the ascites endangers the mother's life only at the eighth or ninth month, is it allowable to think of premature artificial delivery?

If the uterine dropsy, of which we are about to speak in detail, complicates the ascites, and we are able to ascertain that the sufferings of the patient are in good measure due to the extreme size of the uterus, I think the tapping would be insufficient, and that the artificial induction of labor may be attempted with advantage; still, though common, the hydramnion is not a necessary complication, and it seems to me that ascites can very rarely require premature delivery.

In the eighth, and especially the ninth month, the evacuation of the peritoneal fluid will afford sufficiently lasting relief to enable the woman to reach the regular term of pregnancy; or, at least, it will rarely be necessary to repeat the operation more than once. Such was the case with the patient of Ollivier. The only fault to be found with the puncture is that of being merely palliatory, whilst it exhausts the strength if frequently repeated. But should the relief afforded be such that one or two punctures enable the patient to reach the end of the ninth month with moderate suffering, I see no reason for not preferring it to premature delivery, which always places the child in unfavorable conditions.

ARTICLE V.

LESIONS OF INNERVATION.

[§ 1. ECLAMPSIA.

On account of its danger and the nature of the convulsions which characterize it, eclampsia takes the foremost rank in the diseases of women. It is liable to appear suddenly either during pregnancy, at the moment of delivery, or subsequent to the removal of the placenta; it occurs, however, more frequently during labor, and will, therefore, be studied in connection with the accidents of dystocia. (See *Dystocia.*

§ 2. VERTIGO. GIDDINESS. LIPOTHYMIA. SYNCOPE.

These affections are due to various causes. Usually they seem to depend upon great nervous susceptibility, occasioned by pregnancy and heightened by chlorosis;

less frequently they result from plethora, in which case blood-letting becomes, exceptionally, the best method of treating them. Sometimes, also, vertigo and giddiness accompany albuminuria, and precede eclampsia. (See *Albuminuria*, and *Eclampsia*.) In the majority of cases, neither plethora, albuminuria, nor eclampsia are observed in connection, so that the above named affections seem to be due simply to a perverted action of the nervous system; an unsatisfactory explanation, but really the only one which can possibly be given.]

Thus some delicate, nervous women are subject to faintings, from the most trifling cause, when they are pregnant; any strong moral impulses, such as joy, or anger, and sometimes even an odor that is a little too penetrating, or the sight of an unpleasant object or person, may give rise to this condition. Gardien relates an instance, where the simple movements of a child produced swoonings; and I have attended a lady who fainted three or four times a week, during the second, third, and fourth months of her gestation, without any satisfactory cause being discovered for it.

Ordinarily, the syncope attacks the woman when standing, and she at once experiences a ringing in her ears, vertigo, dimness of vision, weakness in the knees, and she has scarcely time to sit down, before she faints away. Some females, however, are warned of the attack by the occurrence of yawning, and a sensation of heat in the precordial region; soon after, the extremities become cold, the face grows pallid, and is covered with a cold sweat; the senses and intellectual faculties are almost lost, the pulse and respiration have nearly ceased, though a total loss of the intelligence and sensibility is very rare. For my own part, I have never seen any woman in this latter state, since nearly all those whom I have carefully questioned on the subject have stated that they had a confused idea of what was passing around them; and therefore, if there really be any instances of a complete abolition of the faculties, they certainly are not so frequent as the authors would have us believe.

While the syncope lasts, we should employ the ordinary means, such as ammonia, vinegar, cold water, &c., &c. The tonics combined with antispasmodics have been recommended for its prevention: for instance, Van Swieten highly extols the use of orange-peel with canella, or lemon-rind and canella, in the proportion of two or three drachms to three pounds of sherry-wine, of which three or four tablespoonfuls are to be taken daily. Chambon has employed an infusion of peach-blossoms with success. All these nervous disorders are more alarming than serious. We have never known them to endanger the life of the mother, or to disturb the regular course of gestation.

The attacks of fainting, though generally short, are sometimes quite prolonged. In the latter case, they are frequently accompanied or followed by some hysterical symptoms, as sense of oppression, hypogastric pain, constriction of the fauces, and sometimes true hysterical convulsions. In the case of a young lady, a patient of M. Rayer's, these symptoms occurred almost every evening after dinner, during the last three months of her pregnancy. They had no serious consequence, unless a threatening of premature labor towards the end of the eighth month be so regarded, which, however, yielded to a small bleeding and opiate injections.

§ 3. VARIOUS FORMS OF NEURALGIA. ODONTALGIA.

Various forms of cephalalgia and obstinate hemicrania are often observed during pregnancy. Other neuralgias may also occur with their usual symptoms in various situations. The sensibility of the skin sometimes becomes so acute that the slightest touch gives pain; again there may be the sensation of intense heat in the feet and hands, or else an impression of cold which nothing will remove. (Jacquemier.) The walls of the abdomen are often affected with neuralgic pains, which will be studied hereafter in an article devoted to the subject. (See *Abdominal Pains.*)

Odontalgia is the most common of all the neuralgias of pregnant women. The lower jaw is the one usually affected, the pain sometimes invading one side, sometimes both sides together. It usually occurs during the first half of gestation, not unfrequently commencing shortly after conception, of which it is sometimes the first sign. It commonly ceases from the fourth to the sixth month.

It were not exactly correct to say that every case of odontalgia is a true neuralgia, inasmuch as it is often occasioned by a carious tooth. It therefore becomes necessary, in view of treatment, to make a correct diagnosis, and in order to do so, to give the mouth a very careful examination. (Churchill.)

Mauriceau considered bleeding the best remedy for the toothache of pregnant women, yet it is a measure by no means certain, and in some cases entirely inadmissible. It is recommended to guard against constipation by the use of mild purgatives taken at short intervals, and as local applications, the use of gargles containing opium, and plasters of opium and hyoscyamus. Internally, some of the preparations recommended for facial neuralgias may be tried; such as pills of cynoglossus or Meglin's pills. Should the paroxysms and remissions be well marked, and more especially should there be an actual intermission, the best effects might be anticipated from the use of quinine. No active measures should be resorted to unless the pain be very great, depriving the patient of sleep and rendering mastication almost impossible, for the contact of foreign bodies with the teeth is sometimes insupportable. (Jacquemier.) Capuron says that toothaches which had resisted all kinds of remedies have been known to subside spontaneously about the third or fourth month of gestation.

Should the gums be inflamed, one or more leeches might be applied. If the trouble is occasioned by a carious tooth, efforts should be made to relieve it by the measures commonly employed, the best being cauterization of the offending tooth. As most authors think that extraction might cause abortion, it would be well to advise patients not to undergo the operation.

§ 4. PARALYSIS.

Pregnant women are not exempt from the causes which produce paralysis under ordinary circumstances, but are even more liable thereto than other females of their age. That such is the fact the recent researches of Fleetwood Churchill and Imbert-Gourbeyre have established beyond a doubt.

Churchill reports 34 cases of paralysis derived from various authors or observed by himself. In 22 of them, the attack occurred during pregnancy, and in the remaining 12, either during or after labor. The location of the paralysis is noted as follows: 17 cases of complete hemiplegia and 1 in which it was partial; 4 of paraplegia, in 2 of which but one leg was paralyzed; 6 of facial paralysis, 3 of amaurosis, and 3 of deafness; in some of the latter cases, however, the local affection was connected with hemiplegia. Of these 34 cases, 4 were fatal.

Of the 22 cases occurring during pregnancy there were 12 of hemiplegia, 1 of paraplegia, 4 of facial paralysis, 2 of amaurosis, and 3 of deafness. Analysis of these cases shows no regularity in regard to the period of gestation at which the attack occurred, though it seems that the patients were more liable to the affection

during the latter months. Most of them recovered before or after delivery, though some continued to be affected for a considerable time. But one case was fatal, and in this it was evident that the result was due to a disease of the brain antecedent to the pregnancy rather than to the paralysis which had increased during the latter; so that this single case by no means invalidates the conclusion as to the relatively trivial character of these attacks during pregnancy.

It is often very difficult to determine precisely the influence which pregnancy may have in the production of the paralysis. In our brief exposition of the state of knowledge on the subject, we shall have in view only such cases as occur during pregnancy, and thus endeavor to avoid being led off into the general subject of internal pathology.

The causes of puerperal paralysis are various; in the first place we would mention cerebral apoplexy, which is not very uncommon in pregnant women. Ménière reports in his excellent treatise several cases of the kind, and, at a later date, M. P. Dubois, whilst discussing the subject in a clinical lecture, came to the conclusion that the frequency of its occurrence proves the existence of some connection between it and the pregnant condition. How then shall the connection be explained? By plethora or hypertrophy of the heart? Both these views could doubtless be well defended, but M. Imbert-Gourbeyre believes that the apoplexy is due to albuminuria, which is well known to be common during gestation. He cites in support of his view several cases of Bright's disease which terminated in cerebral hemorrhage, and calls to mind that it is by no means a rare attendant upon eclampsia. More well observed cases are necessary to enable us to determine conclusively the value of this opinion.

According to Churchill and Imbert-Gourbeyre, uræmia is almost the only cause of puerperal paralyses, such as amaurosis, deafness, and hemiplegia. As regards amaurosis and deafness, we freely accept their opinion, but have some doubt as regards hemiplegia. Most authors, in fact, think that uræmia never occasions either hemiplegia or paraplegia (see *Uræmia*), but however this may be, the so-called uræmic paralyses sometimes accompany an attack of eclampsia or else are preceded by it.

After cerebral hemorrhage and uræmia, anæmia deserves to be mentioned, as also hysteria, a reflex action whose point of departure is located in the uterus, but whose influence extends to the spinal marrow; — rheumatism, etc., may also be noted as causes.

We have thus endeavored to show that the causes of puerperal paralyses are both numerous and variable, so that it will be evident that the prognosis and treatment will have to be modified in the different cases. The ordinary rules of pathology must serve as a guide in the course of medication to be followed.

1. *Amaurosis*, — which is of common occurrence in cases of albuminuria.

It varies in degree from the slightest amblyopia to perfect blindness. It usually affects both eyes, though Imbert-Gourbeyre says that he has known but one eye to be involved. Though generally of short duration, it may sometimes become permanent and incurable. It may also be the first symptom to call the attention of the physician to the possible existence of albuminuria, and is therefore of the greatest value as a premonitory symptom in the diagnosis of eclampsia (see *Eclampsia*). It may make its appearance before, during, and after labor, and recur in several successive pregnancies. If the eyes be examined with the ophthalmoscope, the retina will sometimes appear to be healthy, whilst at others a fatty alteration will be observed or an effusion of blood; regard will be had to the latter in the formation of a prognosis.

2. *Deafness.* — Puerperal deafness is less frequent than amaurosis, and like it is connected with albuminuria and caused by uræmia. The deafness is generally imperfect and almost always preceded by roaring in the ears. Like amaurosis, it

may be intermittent, permanent, periodical, single or bilateral; may change into exaltation of the sense of hearing, be connected with other symptoms of albuminuria, or exist alone, although it accompanies amaurosis as it were by preference. We shall learn hereafter (see *Eclampsia*), that buzzing in the ears and deafness often precede and announce an attack of eclampsia (Imbert-Gourbeyre.)

3. *Facial Paralysis.*—In connection with amaurosis and deafness may be placed paralysis of the third and seventh pairs of nerves—although it is much less frequent.

4. *Hemiplegia.*—Hemiplegia during pregnancy is of common occurrence, and M. Imbert-Gourbeyre has reported a large number of cases in his memoir. Sometimes it is caused by cerebral apoplexy; at others, no lesion of the nervous centres is discoverable at the autopsy, whilst the numerous examples of rapid and permanent recovery seem to prove that there could have been no grave lesion of the brain or spinal marrow. Albuminuria alone and often eclampsia have been observed with hemiplegia, so that Imbert-Gourbeyre feels no hesitation in saying that uræmia is the usual cause of this form of paralysis. As has been said, we do not partake wholly of this view (see *Uræmia*).

Hemiplegia may sometimes also be caused by anæmia, as shown by the following case: A young lady had, during the early months of her pregnancy, an imperfect hemiplegia characterized only by weakness and numbness. The symptoms were of short duration and recovery rapid and complete. In the absence of any other appreciable cause, the affection seemed to be due to a well-marked chlorotic condition.

Paralyses are not rare in hysterical women. There is nothing to prove that pregnant females enjoy any immunity in this respect, so that should any of the symptoms peculiar to hysteria exhibit themselves, it would be reasonable to attribute the paralysis to the pre-existing neurosis. In some patients even, the hysteria may appear for the first time during pregnancy and be attended by various paralyses. It ought, however, to be noted that hemiplegia is rarely dependent upon hysteria.

Finally, when no cause can be discovered, we say in order to conceal our ignorance, that the paralysis is essential.

5. *Paraplegia.*—Beside the usual causes of paraplegia, and independently of all those above noted, this paralysis may be occasioned by pressure of the fœtal head upon the nerves of the pelvic cavity or by reflex action. Paraplegia from pressure upon the nerves by the head ought to be rare during pregnancy; it has been more commonly witnessed during labor and after delivery, especially when the labor has been severe or attended with hemorrhage; we have nothing further to say in regard to this cause.

It is acknowledged, as stated, that paraplegia may be caused by reflex action; but how, in these cases, can its production be explained? How can a partial excitement of the uterus so react upon the spinal marrow as to suspend its functions? Without pausing before the various theories proposed by modern physiologists, we would say that, according to M. Jaccoud who wrote a remarkable work upon the subject, paralysis is occasioned by exhaustion of the nervous system, and that numerous experiments upon animals tend, at least, to prove the correctness of his view: "A long continued, abnormal, excitement is transmitted to the spinal cord by the uterine nerves: after a longer or shorter time it exhausts the excitability peculiar to the corresponding region of the organ, and the inertia of these nervous elements under the action of the brain closes the avenues by which the motor impulse is transmitted; as a necessary consequence of this state of things there results paralysis of all parts situated below the affected points."

The following case of Echeverria's, which the author and others after his example have given as a type of the so-called reflex paraplegia is, to my mind, an absolute demonstration of the theory just stated,—allowing the finger to be laid, as it were,

upon the pathological mechanism of the paralytic affection. A woman who had miscarried three times, continued to suffer after the last one severe pain in the hypogastrium accompanied by a slight metrorrhagia. Seventeen days after the abortion the uterus was found to be anteverted; it was soft and voluminous, rising an inch above the pubis; the neck was sensitive, bled easily, and admitted the finger; the anterior lip was covered by a painful ulcer of a violet-red color.

Having determined these facts, Echeverria, with the double object of exciting the contraction of the uterus and hastening the cicatrization of the ulcer, had recourse to electricity by placing one pole of the apparatus upon the pubis, the other in the orifice of the cervix, and then transmitting a current of low power. Instantly violent pain was experienced in the womb, loins, and lower extremities, which were seized with convulsive tremors. The current was immediately suspended, when it was found that in place of the convulsion there was complete paraplegia which lasted for fourteen hours (Jaccoud). Is it not evident that we have here a case in which extreme excitement exhausted the irritability of the spinal cord? Loss of motion resulting and continuing until the functions of the nervous centre had been restored by adequate repose.

The causes of paraplegia may be various and combined, of which the following case is an example. A young primiparous lady, of extremely lymphatic temperament and affected with general œdema, had a tedious labor requiring the use of the forceps. Extensive laceration of the perineum occurred, and profuse hemorrhage attended the delivery of the placenta. The lying-in was also complicated by a double phlegmasia alba dolens, pleuritic effusion, and ascites. I attended this patient with my friend Dr. Siredey, now hospital physician, and we assured ourselves at various times that the urine contained no albumen. When convalescence was established, it was found on getting the patient up that she had paraplegia. For several months she was unable to stand, but the power of motion gradually returned until at length walking was possible with the assistance of a cane. Whilst this improvement was in progress the paraplegia suddenly became complete, the aggravation being afterward found to have coincided with the time of her becoming again pregnant; and throughout the gestation no improvement took place. During labor the limbs were thrown wildly about in a way which the patient would have been incapable of doing by any exertion of her will. After delivery the power of motion was again wanting. The paraplegia continued for several months without much amelioration, but finally disappeared under the use of strychnine and electricity, the recovery having been now for a long time perfect. In this case, thus briefly related, it would be reasonable to refer the beginning of the paralysis either to pressure by the head of the child during the first labor, or to the hemorrhage attending the delivery of the placenta; but how shall we explain the recurrence of the affection during the next pregnancy? In my opinion, the cause of the new phase of the disease must be regarded as an instance of reflex action.]

§ 5. Intellectual Disorders. Insanity.

Those physicians who may be willing to admit the truth of the analogy which we have endeavored to establish between the sympathetic disorders of pregnancy, and those observed in young girls suffering from difficult or irregular menstruation (p. 462), will readily understand the functional aberrations of the intellectual and sensorial faculties so often observed in pregnant women.

The pre-existing alterations of certain organs of the senses are sometimes very happily modified by the occurrence of pregnancy. A young woman, whose imperfect vision had obliged her to use spectacles from childhood, found her sight so much improved immediately after the beginning of preg-

nancy as no longer to have need of glasses. (Obs. de Salmat, Cent. III. Obs. 27.)

At other times there is greater or less disturbance of the affective and intellectual faculties. I knew a young lady pregnant for the first time, whose former love for her husband was replaced by an antipathy which she was barely able to overcome. Another young woman, when five months gone, was suddenly seized with such an aversion for her apartment, that after many fruitless efforts, and notwithstanding all the force of her reason, she had to be left in the country for the remainder of her pregnancy.

Some exhibit a peculiar tendency to sadness, which is mentioned by Burns, and of which I have observed two cases. Certain individuals, who are usually of a gay disposition, suddenly become sad and morose; refuse all the enjoyments tendered to them, and entertain the belief that they will not survive their labor, with a tenacity that nothing can overcome. A young American lady, recommended to my care by M. Rayer, exhibited a profound melancholy for the last six weeks of her pregnancy. Although surrounded by her family, she declined all the pleasures of the capital. She wept unceasingly over her inevitable end, which was so near at hand, and was constantly expressing her distress at being obliged to leave all whom she loved. She had a happy labor, and from the next day her usual gayety was resumed.

[Disorders of intelligence may proceed even to insanity; although this form is more common with newly-delivered females than with pregnant women. Marcé's excellent book, which shall be our guide in the preparation of this article, gives as the result of several collections of statistics, that of 310 cases of puerperal insanity 27 came on during pregnancy, 180 after delivery, and 103 during lactation.

Puerperal insanity may date from the time of conception, or may appear during the course of gestation. In 19 of Marcé's cases it commenced with conception eight times, and in the remaining eleven during pregnancy. It began three times in the third month, once in the fourth month, three times in the sixth month, twice in the seventh month, and twice at times which could not be clearly ascertained. Melancholy seems to be the most common form of this insanity. Analysis of the above-mentioned 19 cases shows that the duration of the disease is very variable. Seven times the recovery dated from delivery; twice only did it occur during the course of gestation; nine times the disease continued, or else did not subside until long after delivery; finally, in one case, the delirium was exasperated by delivery, and death occurred shortly after. The physician ought, therefore, to be very guarded in his statements when questioned in regard to the probable result. It is well also to know that when a woman becomes insane during gestation, there is reason to fear a recurrence, should she again become pregnant.

Montgomery mentions the case of a woman who became insane at the commencement of three successive pregnancies. In another case, the derangement recurred in eight pregnancies, and ceased only after delivery. By a curious anomaly, however, it happens that some women suffer from this affection in one of their pregnancies only.

Hitherto we have studied the influence of pregnancy as productive of mental alienation; but there remains another question, the discussion of which will not be devoid of interest, to wit: What are the effects of pregnancy occurring in a woman who is already insane? In regard to this, Esquirol says, "Pregnancy, labor, and lactation are sometimes used by nature as a means of curing insanity, though, in my opinion, this result is rare." Almost always, indeed, pregnancy

gives to mental alienation a character of extreme gravity, either as regards its form or its duration. It is evident, therefore, that the practice of some physicians who recommend pregnancy for insane women cannot be too strongly censured.

Labor itself, in its last stages, especially when the pains are extremely severe, may occasion disorder of the intellectual faculties. All accoucheurs, indeed, have described the excitement of mind which occurs under these circumstances, and which in some rare cases assumes the form of maniacal delirium. To the examples already noted on page 300, we add the following. A woman in the hospital of the Clinique was suddenly, when near the termination of her labor, afflicted with a complete hallucination; she saw a spectre at the foot of her bed, endeavoring to injure her, and which she made strong efforts to drive away. The illusion lasted hardly two minutes before her mind became perfectly sane. The transitory insanity occurring thus during labor is doubtless caused by the excessive pain. Notwithstanding its apparent gravity, it is rarely followed by serious consequences if care be taken, by sufficient watchfulness, to prevent the lamentable acts to which the patients might be impelled. It subsides spontaneously, and very rarely passes into long-continued mania.

The part of the physician, in these cases, is easily pointed out. Generally everything will be left to nature; but should the labor last too long, delivery should be effected by the forceps. Blood-letting at a later period, should it be indicated by the signs of plethora, antispasmodics and judicious expectant conduct, will suffice for the successful management of an occurrence which in itself presents but little gravity.

There remain a few observations to be made upon the subject of the insanity of lying-in women and nurses, known as *puerperal insanity*. As predisposing causes of this affection may be mentioned inheritance, numerous pregnancies, advanced age of the subjects, previous attacks of insanity, eclampsia, and the return of menstruation. Sometimes the disease commences suddenly, but is often preceded by an accelerated pulse, heat of skin, dryness of tongue, thirst, and the entire assemblage of pyretic symptoms.

The various forms of mental alienation are far from occurring with equal frequency under these circumstances, but may be represented in the following order: first, mania; secondly, melancholia and partial insanity.

The mania of lying-in women ends in recovery, incurability, and, in some rare instances, death. Of these, recovery is by far the most frequent termination, and may be said to include about two-thirds of the entire number of cases. Cases are mentioned in which the affection subsided in less than three days, though it more commonly terminates within the first month following the commencement of the attack. Again, recovery may be postponed as late as the sixth month, or not take place until after one, two, or more years. The prognosis is most favorable in melancholia and monomania.

A great variety of remedies have been recommended in the treatment of puerperal mania. Warm baths, purgatives, and narcotics are the most available at the outset. It is of the greatest importance to watch the patients, and not lose sight of them for a moment. The children should be taken away (Marcé)]

ARTICLE VI.

DISEASES OF THE SKIN.

§ 1. Itching.

The skin, during pregnancy, is sometimes affected with extreme itching without any appreciable lesion. M. Maslieurat-Lagemart has published a remarkable case of a lady who, in eight successive pregnancies, was afflicted

with itchings so violent as to produce premature labors. On four occasions, they began in the sixth month, twice at eight months and a half, and twice in the seventh month. They appeared almost instantly over the entire cutaneous surface; the legs, thighs, genital parts, the whole trunk, the neck, face, scalp, were all affected; nothing escaped but the palms of the hands, and even they were invaded at a later period. So severe were they, that the violent rubbings of the poor sufferer excoriated the skin. Hardly was she delivered when they vanished entirely. The skin retained its natural transparency, color, and brightness throughout. Simple and alkaline baths, ammoniacal and camphorated frictions to the spine, preparations of opium, bismuth, valerian, hyoscyamus, belladonna, and bleeding, were all employed without advantage.

Three cases of general itching which I have had occasion to treat, yielded quite promptly to alkaline baths. (Five ounces of carbonate of potash to an entire bath.) Lotions of carbolic acid, glycerine, and water seldom fail to relieve this condition.

[§ 2. Pigmentary Spots. Pityriasis.

The skin during pregnancy often becomes affected with yellowish spots known as ephelidæ, *chloasma*, and *pityriasis versicolor*. When they appear on the forehead, cheeks, and chin, they receive the common name of *mask*. These spots affect by preference the face, especially the forehead; they vary in size, are almost symmetrical in form, and never extend to the roots of the hair, from which they always are separated by a border of healthy skin. It would seem that the action of light is one of the principal conditions of their formation, and that the shadow of the hair is sufficient to arrest their progress.

M. Hardy, physician of the Hospital St. Louis, classifies them as ephelides and pityriasis.

The *ephelides* make no projection from the surface, and are attended by neither itching nor desquamation; their examination would almost lead one to say that the pigmentary matter had left the healthy parts and collected in the spots, on account of the apparent bleaching of the skin around them. They are the result, simply, of an accumulation of pigment within a circumscribed space. Ephelides often appear in women at the menstrual period, and more especially during pregnancy: they usually vanish after delivery, though, much to the chagrin of those affected, this does not always happen. When they continue, a special treatment, having for its object the production of a superficial inflammation of the skin, will often prove successful. To effect this, M. Hardy recommends frictions to be made twice a day with the following lotion:

℞.—Water,	. . . . .	℥iv.
Corros. Sublim.,	. . .	gr. v.
Sulph. Zinc,	. . . . .	ʒss.
Acetate of Lead,	. . . . .	ʒss.
Alcohol,	. . . . .	*q. s.*

to dissolve the corrosive sublimate.

Should the lotion fail, sulphurous douches, especially with the mineral waters of Luchon and Baréges, applied to the affected parts, may be used with advantage.

Pityriasis versicolor, also termed hepatic spots and chloasma of pregnant women, appear in the form of spots bearing strong resemblance to the ephelides. In pityriasis, however, the spots project slightly from the surface of the skin, and the epidermis becomes detached in the form of little scales, either spontaneously or by scratching. They are always accompanied by itching, which is generally slight. The characters just mentioned will suffice to distinguish *pityriasis versicolor* from

epnelides, in which there are neither elevation, desquamation, nor itching. Pityriasis versicolor is a parasitic disease, so that the microscope affords another means of diagnosis by exhibiting the spores and numerous ramifications amidst the epithelial scales.

The pityriasis of pregnancy usually declines after delivery, though in some cases it remains and offers great resistance to the treatment employed.

The therapeutic measures are very simple. Sulphurous waters, by lotion or douche, and ointments containing sulphur, are often effectual. The above lotion (see formula) and nitric acid ointment produce similar results.]

ARTICLE VII.

LESIONS OF THE PELVIC ARTICULATIONS.

§ 1. Relaxation of the Pelvic Articulations.

The question has long been agitated whether the ligaments which unite the bones of the pelvis are ever softened, and whether the articulations are movable. Ambrose Paré himself, that great surgical luminary, did not adopt the opinion of Hippocrates until after Severin Pineau made a dissection, in 1569, of a woman recently delivered, in his presence. But, at the present day, this question is determined by a very great number of cases, and it is now generally admitted that a ramollissement of the symphyses actually occurs in most females during gestation.

This softening may be and generally is slight; though it may be carried to so great an extent as to admit of considerable separation between the articular surfaces, constituting then a true pathological alteration. Hunter, Morgagni, and some others, cite instances where the relaxation was such that the pubes could be drawn more than an inch apart.

With our present knowledge on the subject, it is impossible to explain the cause of this softening; for, when trifling, it generally escapes the notice both of the woman and her physician; but if well marked, a separation of the bones takes place as just stated.

Authors do not agree as to the manner in which the separation is produced; since, according to some, the cartilages are softened and thickened by the liquids that penetrate them, acting like a piece of prepared sponge placed between two bones to absorb the effused fluids; whilst others imagine them to resemble the roots of the ivy, which insinuate themselves into the little crevices between the stones of a wall, and finally overturn it. Louis thinks they act more like dry and porous wooden wedges placed in the fissures of a rock, which, by imbibing moisture, swell up and ultimately split the rock,—or like polypi in the nasal fossæ and frontal or maxillary sinuses.

M. Lenoir supposes that a slight degree of this relaxation is due simply to serous infiltration of the pelvic ligaments resulting from the pregnant condition; the articular surfaces are, therefore, not separated, though separation is possible under the influence of actions tending to produce it. In the more advanced stages, he adds to this softening a hypersecretion of synovia, which distends the articular cavities, and separates the bones that constitute them. Mobility in these cases is great, and if the joints be opened in the dead body, a viscid fluid is discharged abundantly, as was once observed by Morgagni

This relaxation may, according to Baudelocque, oppose the spontaneous termination of the labor, by destroying the *point d'appui* which the abdominal muscles derive from the bones of the pelvis; and perhaps, also, the distress produced by the engagement of the head, forces the woman to restrain the pains as much as possible; though, on the other hand, from the observations of Desormeaux, Smellie, &c., we learn that this circumstance, so far from being a cause of dystocia, has actually permitted a spontaneous delivery in some cases where the disproportion between the size of the head and the dimensions of the pelvis would have otherwise rendered it impossible.

[The attention of physicians has, of late years, been again called to the study of the relaxation of the pelvic symphyses by a work of M. Ferdinand Martin, which was soon followed by M. Danyau's report. A special article was devoted to the subject in the previous editions of this work, so that M. Trousseau was wrong in supposing that it had been omitted. (*Leçons Cliniques sur le Relâchement des Symphyses du Bassin*, May, 1865.) Nevertheless, as the affection is still badly understood, frequent errors in diagnosis are the consequence.

The pains in the back which many pregnant women suffer, are due simply to relaxation of the symphyses. To be convinced of the fact it will be sufficient to examine the lumbar region by pressure over the sacro-iliac articulations when, if they be diseased, decided pain will follow. The same remark applies to the symphysis pubis, which is often the seat of the vague pains complained of in the lower part of the abdomen.

In all these cases it is the more easy to be deceived, as the patients, on being questioned, are rarely able to define clearly the seat of their suffering, and the real affection is overlooked if care be not taken to make a direct examination. How often is the uterus regarded as the source of the pain, when the lesion is precisely located in the pelvic articulations!

The spontaneous pains produced by relaxation of the pelvic symphyses are more particularly awakened by motion of the lower extremities, as in walking and standing, and usually subside upon lying down. In slight cases walking is difficult, the patients are soon fatigued, drag their limbs, and are unable to stand upon one foot. In a more advanced stage, walking becomes increasingly difficult, painful, and finally, impossible. When the patient would stand, the sensation is as though the sacrum descended between the iliac bones, or as though the body would drop between the thighs. It is then quite possible by moving the lower extremities to perceive the motion of the ilia, and sometimes even a very sensible crackling or clicking can be detected. In one of M. Trousseau's patients the end of the forefinger could be readily inserted between the two pubic bones and a softened condition of the interarticular cartilage perfectly detected.

Relaxation of the pelvic symphyses is often greater after delivery than during gestation, and though more evident during the lying-in, is still often overlooked, and the pains which it occasions attributed to metritis or uterine displacement. In all these cases, however, the symptoms are the same and require similar treatment.

The prognosis is variable; in slight cases no treatment is required and the affection disappears after delivery. In a more advanced stage, rest in bed is insufficient, and an appropriate treatment becomes necessary. Sometimes three, six, or eight months, or several years, are required for the consolidation to take place. In one of M. Martin's patients the cure was postponed until after another labor. There are facts, indeed, which go to prove that relaxation of the symphyses may continue through life in spite of the best treatment. Finally, in the following article we shall speak of inflammation and suppuration of the symphyses, which may also occur and lend fresh gravity to the affection.

As soon as the relaxation is discovered, the patient should be put to bed and kept strictly at rest, with the pelvis held motionless by means of a compressory bandage. For this purpose a towel passed around the pelvis and drawn very tight, may answer in the simplest cases. The procedure is at once a rational treatment and a means of diagnosis, inasmuch as relief is generally immediate, and if successful, leaves no doubt as to the nature of the disease. Bandages of linen or ticking are, however, liable to stretch and loosen in a very short time, in which case a good substitute is found, according to Boyer, in a leather belt quilted internally and caused to surround the pelvis between the great trochanter and crest of the ilium and buckled in front. The best apparatus, however, is the one recommended and used by M. Martin. It is composed of a strong circular piece of metal two inches wide, open in front, and large enough to embrace the entire circumference of the pelvis. It is padded and quilted like the spring of a truss and provided at one end with a strong strap and with a buckle at the other, whereby the ends are brought together and held firmly. This apparatus has the advantage of being applicable during pregnancy without interfering with the development of the abdomen, and is even more useful after delivery. Although its weight is considerable, the patients soon become accustomed to its use. It secures immobility of the bones so fully that absolute quietness is no longer necessary, and the patients may walk every day without the recovery being interfered with.

"We owe," says M. Danyau, "the acknowledgment to M. Martin, that his belt fulfils all the indications, and that none other does so more effectually. Not only is it, like Boyer's, narrow enough to clasp the pelvis where the pressure can produce neither interference nor injury and be at the same time really effective, that is to say, between the crests of the ilia and the great trochanters, but what is not less important, it is so strong and stiff that when once applied and the bones brought in contact by it, separation afterward becomes impossible."]

When to relaxation of the pelvic articulations, inflammatory symptoms are added, they should be met by the appropriate means; in their absence, we may apply gentle pressure around the pelvis, and make use of some topical applications, general and local tonics, and astringent and resolvent lotions. After the total disappearance of the lochia, Desormeaux highly extols the employment of douches, sea-bathing, a good diet of nutritive articles, the Spa and Seltzer waters, wearing flannel next to the skin, and dry frictions. We cannot recommend too highly the use, in these cases, of the steel girdle of M. Martin, which, when tightly drawn around the pelvis, immediately restores a portion of its normal solidity, and facilitates the cure wonderfully.

These measures should be continued for a long time, and even when convalescence is fully established, the greatest possible care must be exercised in rising, walking, &c.

§ 2. Inflammation of the Pelvic Articulations.

Inflammation of the pelvic articulations, which is sometimes observed after labor, may also occur, though more rarely, during pregnancy. Drs. Hiller, Monod, Danyau, and Professor Hayn, of Königsberg, have mentioned instances of it.

The disease generally begins without appreciable cause with sudden, acute, sometimes lancinating, though usually heavy pain, in one or several of the pelvic articulations. The pain is increased by pressure, standing, and especially by attempts at walking, which is sometimes altogether impossible.

These pains often extend into the lower extremities, and especially into the thighs. Swelling can sometimes be detected over the inflamed articulations

These articular pains are sometimes attended by a febrile movement, which is occasionally severe, though generally quite moderate. In some cases, indeed, there is almost no general reaction.

The inflammation, when moderate, usually yields promptly to proper treatment; the cure is almost perfect after twelve or fifteen days, and the delivery and lying-in seem to experience no unfavorable effect from it. In some cases, however, whether in consequence of the intensity of the inflammation, or because the proper means were not employed with sufficient energy, the disease ended in suppuration, and in two instances proved fatal. In these cases, the articular surfaces were found denuded of cartilage. MM. Hiller and Monod mention two cases which proved fatal in this manner.

If the pains are very acute, and the general reaction decided, general and local bleeding may be employed at the outset. But when there is no fever, and the local symptoms are moderate, we may be content with resolvent applications, restricted diet, and absolute repose in the horizontal posture. Narcotics may be added to the resolvent applications, if the pains are too severe.

ARTICLE VIII.

DISEASES OF THE VULVA AND VAGINA.

[Various lesions of the vulva and vagina impede delivery, and are therefore discussed in the article on Dystocia. At present we shall describe only pruritus of the vulva, leucorrhœa, and vegetations, as they occur in pregnant women.

§ 1. Pruritus of the Vulva.

Pruritus of the vulva, though not peculiar to, often occurs during pregnancy. It is characterized by intense itching of the external genital parts, the labia majora and minora, and often extends even into the vagina. The itching is irresistible, obliging the patients to scratch themselves, and thus, in consequence of the relief afforded, leads to a sort of masturbation.

Examination of the affected parts discovers no appreciable alteration: sometimes there is redness, at others some exudation of serum with superficial ulcerations reminding one of eczema. (Hardy.)]

The itching was so insupportable in a young married lady under my care, that she could not refrain from continual scratching, and the general irritation resulting therefrom almost threw her into convulsions.

In another instance, a young girl, who wished to conceal her pregnancy, was so tormented by this disease, that it was absolutely impossible to hide her distress from the observation of her family; and when I examined her, I found the internal face of the labia externa, and the nymphæ, both swollen and inflamed from the constant scratching; the nympha on the right side had been so long, and so strongly dragged upon, that it had acquired twice the usual length at least. Generally speaking, the frequent use of bathing, and of the vegeto-mineral lotions applied five or six times a day, will calm the itching; and as it is often greatly aggravated by walking, perfect rest is

of course indicated. Some advantage is often to be derived from a fine compress dipped in oil of sweet almonds, and then placed in the vulvar fissure; or still better, if the compress be soaked in lead-water.

Dewees states that he examined a young lady who complained of this excessive itching in the genital parts, and he found the internal face of the vulva, as also the inferior part of the vagina, covered by numerous aphthæ; and that the application of a strong solution of borax, four or five times a day, caused them all to disappear in the course of twenty-four hours.

Dr. Meigs has always found the following preparation useful: —

℞ —	Borax,	ʒij.
	Sulph. of morphia,	gr. ivss.
	Dist. rose water,	f℥viii.

Apply three times a day to the affected parts, by means of a sponge or piece of linen, taking care to wash the parts beforehand with soap and water, and to dry them well afterwards. The following solution of bichloride of mercury may also be used with advantage: Add a drachm and a half of corrosive sublimate to four ounces of distilled water, and of this solution let the patient add a dessert-spoonful to a pint of *very warm* water, and use for injections and lotions. Hot water alone will answer in many cases. (Trousseau and Pidoux.)

[Pruritus of the vulva is often very obstinate. In the rebellious cases mentioned, M. Dubois advises that the entire mucous surface of the vulva be cauterized with the solid nitrate of silver. A great objection to it however is, that it is extremely painful and almost always produces but temporary alleviation. We have generally succeeded with a solution of corrosive sublimate, as follows:

℞ —	Bichloride of mercury,	gr. xxxi.
	Alcohol,	fʒiij.
	Rose water,	f℥iss.
	Distilled water,	f℥xv.

This is used as a wash, undiluted, morning and evening, as follows: After using warm water for the purpose of removing mucous secretions from the vulva, and drying the parts well with a piece of fine linen, a small sponge saturated with the fluid is passed rapidly over the entire itching surface, so as to moisten it thoroughly. A smart burning sensation is the first effect of the application, which is alleviated by a few minutes washing with cold water. Subsequent applications are less and less painful, and the cure is generally rapid. We prefer this treatment to all others.]

§ 2. Leucorrhœa.

We shall limit ourselves to a short notice of the profuse leucorrhœa with which women are very often affected during pregnancy. This discharge, which is sometimes white and sometimes of a yellowish-green color, usually makes its appearance during the second half of gestation, though I have seen some persons affected with it from the early months. It is generally coincident with the development of numerous granulations, which, as we have already said, sometimes cover the vaginal mucous membrane, and constitute what has been described of late as *granular vaginitis*. When it is very profuse, an examination by the speculum frequently discovers numerous ulcerations of the neck of the uterus. We shall have occasion

to speak of these ulcerations hereafter. I am convinced that the vaginal granulations and ulcerations of the cervix are very rarely as serious during gestation as they appear to be under some other circumstances, since they generally disappear with the pregnancy, during which they are developed.

Sometimes the discharge is so abundant as to react upon the functions of the stomach, and I have seen several patients with symptoms of gastralgia, evidently connected with the leucorrhœa, inasmuch as they increased or diminished according as the latter was more or less profuse.

This affection often produces, in addition, great irritation, a burning heat, and sometimes an almost insupportable itching of the lower part of the vagina and external genitals. A profusion of small vesicles appear upon the internal surface of the greater and lesser labia, which, by constantly rubbing against each other, finally give rise to excoriation, and render walking very painful.

Frequent baths, lotions, and injections of cold water, to each quart of which a dessertspoonful of subacetate of lead has been added, repeated several times daily, according to the degree of pain, are the best remedies. It will also be found advantageous to separate the parts, by introducing a piece of fine linen between the labia, so as to prevent friction whilst walking. It is unnecessary to say that the introduction of the speculum during pregnancy requires that especial care be taken not to press it too far.

Though the patient's sufferings may easily be alleviated in this manner, it is more than probable that the granulations will continue, and that the discharge will not cease entirely; in spite of all that can be done, it generally lasts until the end of pregnancy, and in the great majority of cases only terminates after delivery.

[Would any disadvantage attend the insertion in the vagina of tampons formed of carded cotton and alum? Would they be likely to occasion abortion or premature delivery? During my present temporary service at the Lourcine hospital, I have found quite a number of pregnant women affected with vaginitis and profuse leucorrhœa, and in all such cases it is the practice there to use the above-named tampons, notwithstanding the fact of pregnancy. I continue them as they have been used heretofore, though not without apprehension; still no accident has occurred as yet. I should desire, however, a longer experience, before I could feel willing to advise them.

Vaginal injections, especially if used indiscreetly, may excite contraction of the uterus and abortion, if the fluid be thrown upon the os tincæ.

§ 3. Vegetations.

The external parts of generation, particularly in women affected with blennorrhœa, vaginitis, or uterine catarrh, often become covered with vegetations, which were long supposed to be of a syphilitic character. They seem always to be connected with the presence of a discharge in non-pregnant females; that their production may also be favored by pregnancy, is a fact established, as I think, by the treatise of M. Thibierge.

The vegetations may appear in pregnant women at any period of gestation. They consist of tufts of a rosy hue, attached by a pedicle, and spreading out like a cauliflower. In respect to number and size they vary greatly.

They may be either scattered or so grouped as to form large masses. A patient in the Hospital of the Clinic had them in the form of a tumor as large as the fist.

They affect more especially the mucous membrane of the vulva, though they also form on the external surface of the labia majora, in the furrow between the buttocks, about the region of the anus and the genito-crural folds: sometimes, even, they sprout from the walls of the vagina or the os tincæ, though in these situations they are generally small.

They are attended with itching, considerable pain, and a discharge. They also exhale a very unpleasant odor, but are really devoid of danger, and occasion no obstruction to delivery, even when of large size. In the majority of cases they disappear spontaneously after delivery; the pedicle dries up, and they fall like a ripe fruit. This favorable termination is not, however, universal.

One of their peculiarities is that of continuing to sprout during gestation in spite of all kinds of treatment. Still, M. Thibierge thinks that the use of local applications during pregnancy may dissipate them when small and few in number. Under other circumstances they are almost certain to return.

In regard to treatment during pregnancy, an attempt may, in the first place, be made to destroy them by local applications, as of alum, nitric acid, or the acid nitrate of mercury applied drop by drop. Excision, and even crushing, are liable to occasion obstinate hemorrhage, so that radical operations ought not to be performed. After delivery, should the trouble persist, any of the methods of treatment used in such cases become applicable.]

ARTICLE IX.

ABDOMINAL AND UTERINE PAINS.

Beside the numerous functional disorders just studied, some pregnant women suffer, in various parts of the body, pains whose intimate cause is imperfectly understood, and to which they sometimes call the attention of the physician. Some of these pains appear to be seated in the abdominal parietes, the lumbar region, the groins, and the internal part of the thighs; others, again, appear to affect more especially the walls of the uterus, or the annexes of that organ.

§ 1. Abdominal, lumbar, and Inguinal Pains.

These pains, which are sometimes confined to a quite limited space of the abdominal parietes, do not often appear before the latter months of gestation. They are frequently felt at the lower part of the breast, near the upper insertions of the abdominal muscles, or, less often, in the inguinal folds near their inferior attachments. The pains are much increased by motion, the least pressure, and sometimes, also, by the movements of the child, if violent. As already stated, they are generally limited in extent, sometimes not affecting a space larger than a silver dollar, the parts surrounding being entirely free from pain.

Since lumbar and inguinal pains, occurring in the first half of gestation, may be the preludes of an abortion near at hand, they claim special attention. At this early period they are almost uniformly the sympathetic expression of uterine disorder, itself due to a local congestion, though perhaps still oftener to a special irritability of the womb. They then resemble precisely the lumbar and inguinal pains which are so often experienced by young girls affected with dysmenorrhœa or amenorrhœa, and are effectually overcome by opiates, small revulsive bleedings, and sometimes, also, in very

nervous women, by warm bathing. If, as is often the case, the pains seem to be increased by sexual intercourse, too long a walk, or riding in a carriage, it were useless to say that abstinence from all these causes, and repose in the horizontal posture, are the first indications to be fulfilled.

These pains most commonly appear toward the end of pregnancy, but their cause, that especially of the lumbar pains, is very obscure. Sometimes, however, it can be ascertained that they are seated in the pelvic articulations (see page 515). Dragging upon the broad ligaments, compression of the lumbar nerves, extreme distention of the uterus, and engorgement of the pelvic and uterine vessels, have been successively adduced in explanation; but though the relief obtained from bleeding, in some cases, would seem to show that they might sometimes be caused by local plethora, there is no evidence of any such influence as is attributed to the other causes mentioned.

The inguinal pains have generally been referred to traction upon the round ligaments. I do not say that this traction may not produce them, but I am convinced that toward the end of pregnancy they are oftener due to the pressure of the uterus upon that region, in the vertical as well as in the sitting posture. They generally disappear, indeed, in the horizontal position, and the best means of relieving the patients is to support the abdomen, and at the same time raise it a little by means of a well-made corset, or of a large abdominal belt, the central portion of which embraces the sub-umbilical region, and whose two ends are attached to the back part of the corset.

[Having for some time made a special study of these abdominal, inguinal, and lumbar pains, we are convinced that very often they are due to neuralgia of the cutaneous nerves from the collateral branches of the lumbar plexus. To be assured that such is the case, it is only necessary to test carefully the sensibility of the skin in these regions, either by rubbing it rudely with the end of a pencil, or by raising it in the form of a fold which is to be gradually pinched between the fingers. Pressure ought also to be made all along the crest of the ilium in the direction of the genito-crural nerve. Should we be satisfied with merely questioning the patients, or depressing the walls of the abdomen by the hand, we would incur the risk of obtaining very little information, or of suspecting the existence of a deep-seated visceral pain when the skin only is affected. This mistake, which we see committed every day, would be avoided by taking the trouble to make the above-mentioned examination, and we cannot recommend it too highly.

The principal parts affected by this neuralgia are the lumbar, iliac, hypogastric, and inguinal points, though the pain may appear in some other portion of greater or less extent of the skin of the abdomen. Sometimes confined to a circumscribed point, it occasionally invades an entire half of the abdominal walls. It very rarely affects both sides at the same time with equal intensity.

The local application of narcotics constitutes the treatment *par excellence*, of these neuralgic pains. We have almost always succeeded with very small blisters sprinkled with one of the salts of morphia. Subcutaneous injections are also clearly indicated, and none of these methods are liable to effect unfavorably the course of the pregnancy.

What we have just written applies especially to the abdominal neuralgia of pregnant women; but before leaving the subject, we desire to say that the same affection is also extremely common after delivery. In the latter case, however,

instead of being the chief pathological element, it is almost always symptomatic of a lesion of some one of the pelvic organs. Its investigation is not, on this account, less important, because, generally, the intensity of an inflammation is estimated by the acuteness of the pain which it produces. Under these circumstances, if the skin be raised carefully between two fingers, and the fold thus formed be pinched, it is often found that the pain is seated partly in the skin and not in the uterus or its appendages. The physician is thus better informed, since a slight metro-ovaritis may be attended by a violent cutaneous neuralgia more alarming by far than dangerous.

The lumbo-abdominal neuralgia which is symptomatic of a metro-ovaritis or of a metro-peritonitis, also enables us to understand certain facts which would be inexplicable without it. Suppose a newly delivered female to be attacked by metritis; the uterus is examined by depressing the walls of the abdomen by the hand, and several examinations carefully conducted assure us that pain is produced about the fundus of the organ. The usual treatment in such a case consists in the application of leeches directly over the seat of pain, and, we must say, almost always affords relief. Is it not surprising that such a result should be produced? How could we suppose that an abstraction of blood from the skin of the abdomen near the umbilicus would act directly upon the fundus of the uterus when all vascular communication between the two parts is prevented by the interposition of the peritoneum? We bow before the facts, yet believe that the bites of the leeches, when they afford relief, do so by acting directly upon the cutaneous neuralgia which is symptomatic of the metritis, and have no effect upon the vascular engorgement of the uterus. The same result would follow the application of a blister dressed with a salt of morphia. As soon as time shall permit, we intend publishing several cases which go to prove what we have just said respecting the part played by lumbo-abdominal neuralgia during pregnancy and in the diseases of lying-in women.]

The pains in the internal parts of the thighs, the numbness and cramps of both legs, though more commonly of one only, are usually attributed to pressure of the head on the lumbar and sacral nerves. But, as Tyler Smith remarks, since they mostly occur at night, when the women are in the horizontal posture, or whilst they are sitting, in both which positions the pressure should be much less than whilst standing, it seems very probable that compression of the nerves is not the cause. Perhaps we may accept the idea of the English accoucheur, that, like the corresponding affections in cholera, they are connected with some irritation or difficulty of the large intestine, or with a morbid condition of the uterus. It would not be the only instance of visceral irritation producing spasmodic contraction of the muscles of animal life by reflex action.

According to this hypothesis, the best means of preventing the recurrence of the cramp is to keep the bowels free, and allay the irritability of the womb as much as possible by baths, opiates, &c. The surest means of counteracting it is to contract voluntarily, the very moment it appears, the antagonistic muscle of the affected one; thus the thigh should be strongly extended when the flexor muscles are contracted, and the foot should be flexed on the leg when the cramp affects the muscles of the calf.

§ 2. Uterine Pains.

1. Beside the uterine pains which sometimes accompany the outset of a disordered pregnancy, also beside those which seem to herald the approach

of labor in the latter weeks of gestation, females experience, at variable periods and intervals, pains which are sometimes very acute, and evidently seated in the walls of the uterus itself. It is impossible to determine the cause and nature of these pains; for though they may be attributed, in some rare instances, to partial spasm of the muscles of the uterus, or to a more or less extensive inflammation, most frequently nothing of the kind is to be discovered. Sometimes they are limited to a single circumscribed point, whilst at others they affect the entire womb. In the first case they are continuous; in the second, they are irregularly intermittent, and their recurrence, or rather their paroxysm, appears to coincide with a motion of the female, pressure upon the abdomen, an attack of coughing, or sudden movements of the child. At the same time the uterine tumor may almost always be felt to become denser and harder: in short, a true contraction takes place, which continues as long as the paroxysm lasts. If, struck with this condition of the body of the womb, an examination be made *per vaginam*, the cervix will be found unchanged, having undergone no alteration which could excite solicitude on account of the long-continued previous contractions. Usually, there is very slight general reaction, and little or no fever.

When the pain is both circumscribed and moderate, emollient and narcotic applications may be found sufficient; but when more severe, it will be necessary to prescribe the most absolute repose, injections with camphor and laudanum, baths, maniluvia, and even bleeding from the arm. It generally yields to these measures when properly employed, though, unfortunately, it returns with some individuals very frequently. I have, at this moment, a young lady under care, who is at the eighth month of her pregnancy, and who has had five attacks within three months, two of them lasting for twenty-four hours. The first time she was bled; but as her general condition seemed to contraindicate a repetition of this measure, and she was very averse to bathing, I was obliged to content myself with prescribing rest and opiate injections. Now, there is every prospect of her reaching her full term.

2. The sensibility of the uterus is sometimes singularly increased by constant and violent motions of the fœtus. Some children, indeed, seem endowed with such activity that they are hardly ever quiet, and their continual movement becomes a cause of irritation to the womb, which, by reacting upon the whole economy, may produce insomnia, general excitement, and nervous and sometimes even convulsive movements. I have seen two instances of these disordered motions of the child; especially was it marked in the case of the wife of one of my professional brethren. This poor lady was delivered at term, notwithstanding she had been almost entirely deprived of sleep during the eighth and ninth months. Burns says, that patients under these circumstances are delivered rather before the ninth month. The bleeding and opiates which he recommends may indeed lessen the irritability of the uterus, but evidently can have no power to diminish the activity of the motions of the child, which is the first cause of the uterine pains.[1]

[1] Dr. Tyler Smith endeavors to show, in a very interesting memoir, that the active motions of the child amount to almost nothing, and that the sensations perceived by

3. Some authors state that metritis, or metro-peritonitis, are possible during pregnancy, but they are so rare that it has never fallen to my lot to see them. Besides, they seem to me to belong to the same category as all the acute affections which may arise during pregnancy; and though the usual gravity of the prognosis be heightened by the condition of the female, the treatment would be the same as after delivery.

§ 3. Rheumatism of the Uterus.

Rheumatism of the uterus, although studied for a long time in Germany, was scarcely known in France, until M. Dezeimeris published in his journal (*l'Expérience*) a series of facts that were previously known to, and put forth by, the German authors. About the same time, M. Stoltz, who was acquainted with the works of our neighbors on the subject, devoted particular attention to this affection at the Clinical Hospital of Strasbourg, and communicated the result of his observations to his pupils. One of them, Dr. Salathé, has quite recently defended a thesis on this subject; and from his work, as also from the bibliographical researches of M. Dezeimeris, I extract the following account of this disease, which is unknown to French nosologists.

According to Radamel, rheumatism may attack the uterus in the non-gravid state; but we have only to study it here as occurring in pregnant females, in whom it may appear at all stages of the puerperal condition. Therefore, after some general remarks on the disease itself, it will be necessary to point out the influence that it may have over the gestation, the parturition, and the lying-in.

Causes.—Every circumstance calculated to favor the development of the rheumatic affections in general, may likewise prove a source of rheumatism of the uterus: thus, a momentary or a prolonged exposure to cold and moisture, inadequate clothing, or sudden changes from a very high to a very low temperature, and all those other atmospheric constitutions which have been enumerated by medical authors, either as predisposing or as determining causes of rheumatism, may likewise produce that of the womb. But, besides these general causes, there is one peculiar to the disease under consideration; that is, the susceptibility of this organ to the impression of cold under the attenuated integuments of the abdomen during the latter months of gestation; for the belly is only covered at that particular point by very light clothing, which is far from fitting closely, and the lumbo-sacral region is often but imperfectly protected by the short jackets worn by the patient.

Symptoms.—Rheumatism of the uterus very often occurs in persons who are constitutionally predisposed to the rheumatic affections; and it may coexist with a general disorder of the same nature, though in the majority of cases the womb, together with its appendages and the adjacent parts, is alone affected. Again, it has oftentimes resulted from a sudden cessation

the mother and accoucheur, hitherto attributed to the muscular contractions of the child, result simply from partial contraction of the muscular fibres of the uterus. Notwithstanding the seductive character of the reasons adduced by Dr. Smith, we hold to the generally received opinions, though entirely disposed to think that the views of the English accoucheur may be applicable to the exceptional cases of which we are speaking.

of a rheumatic pain at some other point, which is speedily transferred to the uterus. But, whatever may have been the mode of its attack, this disease exhibits some well-marked peculiarities, by which it can easily be recognized. The principal symptom is pain, or a distressing sensation, which involves the whole, or a part of the womb, without any violence having been exerted on the organ; its intensity varies from a simple feeling of heaviness to the most painful dragging sensation; and it may occupy either the entire womb, or only one of its parts, such as the body, the fundus, or the inferior segment. When the rheumatism is fixed in the fundus uteri, the pain is particularly apt to be felt in the sub-umbilical region; it is augmented by pressure, by the contraction of the abdominal muscles, and sometimes even by the simple weight of the bedclothes; and in many cases the patient is unable to bear any movement whatever. If seated somewhat lower, she suffers from acute dragging sensations, that run from the loins toward the pelvis, the thighs, the external genital organs, and the sacral region, along the uterine ligaments. Finally, when the inferior segment participates in the affection, the seat of it can be detected by the vaginal exploration, which gives rise to the most acute sufferings. But, of all the causes that may exasperate these pains, there are none more distressing than the incessant movements of the child.

Like all rheumatic pains, those of the uterus are metastatic, and they occasionally pass rapidly from one point of the organ to another; often, indeed, they disappear at once, and pass off to some other organ. This is particularly apt to occur when the pain was originally located at some other point, and measures have been employed to recall the affection to the part primitively attacked.

They present frequent and variable exacerbations in their duration and intensity, according to the stage of the disease; sometimes they are followed by remissions, during which the patient experiences only a vague sensation of weight in the part. The uterine pains are usually accompanied by a recto-vesical tenesmus, which is the more distressing as the former are the more energetic, and are seated near the inferior segment. The patient is then tormented by a continual desire to empty her bladder; the emission of urine is attended by a smarting sensation, and sometimes by acute sufferings, while at others it is even wholly impossible; and in many cases the attempts to move the bowels prove equally ineffectual. Most of the German authors attribute this double recto-vesical tenesmus to a rheumatic affection that is not always exclusively limited to the womb, but which also invades the neighboring organs. But M. Stoltz appears disposed to believe that it is rather the result of the close sympathy existing between these adjacent parts; for, if these new pains were occasioned by a rheumatism of the rectum or bladder, those of the uterus ought to disappear altogether, or at least should be diminished. (*Salathé's Thesis.*)

Analogy would lead us to suppose that an unusual heat and tumefaction must exist in the affected parts; but the difficulties in detecting these characters are self-evident, although their existence is quite probable.

Such acute pains, seated in so important an organ, would naturally produce considerable general reaction; and it is found that this disease, like

the greater number of the inflammatory affections, most usually commences by a slight chill, which lasts for a quarter of an hour or twenty minutes; the fever that follows it diminishes, and sometimes disappears altogether, during the interval between the paroxysms; but, pending their duration, it is usually quite intense, the pulse is frequent and hard, the face excited and flushed, and the tongue is red and dry; the patient complains of thirst, the skin is hot, and she often suffers from an extreme agitation and restlessness. Towards the end of the paroxysm, a profuse perspiration generally breaks out, which seems to be the prelude of a notable amelioration. Then these general phenomena become moderated, together with the uterine pain, but they reappear with the latter, after a variable period, ranging from a few hours to several days.

1. *Influence of Rheumatism over the Progress of Gestation.*—The paroxysms are apt to be followed by uterine contractions in those cases in which they have persisted for some time, or have been very severe; and in this manner they may serve to bring on a premature delivery. The patient experiences some acute and tensive pains, but this feeling of tension is not uniform; for it attains, in turn, a high degree, and then becomes weaker in the same proportion, progressing in this way with shorter and shorter intervals. At first the uterus is indurated to a partial extent, but afterwards throughout; the os uteri dilates, though its dilatation is at first slow and difficult, and its ulterior progress does not seem to correspond with the intensity of the pains. An abortion is then imminent, but it is far from being so frequent as might be supposed; and when it does occur, it is more frequently observed in the febrile than in the apyretic form of rheumatism. The orifice has been known to dilate to the extent of an inch in diameter, and then the bag of waters, that had previously engaged in this opening, insensibly retreated, the os uteri again closed up, and the delivery did not take place. Consequently, so long as the dilatation of the os uteri does not amount to two inches, we may reasonably hope to make the labor retrograde. These uterine rheumatic pains may simulate those of parturition, and thus lead the accoucheur to suspect that labor has regularly commenced, when in fact such is not the case. The characters of the rheumatic pain, furnished in the following paragraph, will aid in preventing such an error. It is probably to some mistakes of this kind that we must refer those pretended instances of prolonged gestation, as well as those cases in which genuine labor was developed, and afterwards suspended during several weeks, and even months.

2. *Influence of Rheumatism over the Labor.*—As a general rule, a rheumatic affection of the womb retards the progress of the labor, and sometimes even renders the spontaneous expulsion of the child wholly impossible. Besides the general phenomena already pointed out, the disease here gives rise to the following peculiarities:

1st. It is well known that the normal uterine contraction only begins to be painful when it has accomplished the greater part of its course, and when it is at the point of distending and dilating the uterine orifice; in other words, the true labor-pain only commences at the instant when the power of the body of the womb overcomes the resistance of the neck. In rheuma-

tism, on the contrary, the uterine contraction is painful from the very first, and prior to any action upon the cervix; hence the cause of the pain is not in the violent distention of this orifice, but rather in the uterine contraction itself, in the other morbid conditions, and in the altered relations of the nerves and contractile fibres of the uterus.

2d. In a normal labor, the contractions begin at the fundus, and terminate at the inferior segment of the womb; in rheumatism, instead of starting at the fundus, they begin in the painful point, and are not regularly propagated towards the cervix. Again, the rheumatic pains exist prior to the contraction of the womb, and then speedily acquire a high degree of intensity under the influence of this latter. At times their violence promptly arrests the contractions, even before they have traversed their ordinary cycle. They are then rapid, short, and become more and more distant.

3d. Towards the end of labor, at the time when the uterine action ought to be aided by the voluntary contraction of the abdominal muscles, the woman refrains from exerting these under the fear of augmenting the pains, whereby an excessive slowness in the labor results. The patient is found in a state of extreme anxiety, and the frequency of her pulse, the heat of the skin, the thirst, and vesical tenesmus, are all greatly augmented. Where these sufferings are much prolonged, she falls into a state of swooning, which often proves serviceable, as the pains are suspended while it lasts; a profuse perspiration has then been observed to take place, which had the most salutary influence over the ulterior progress of the parturition. But at other times the uterus becomes more and more painful, and it is rather in a state of permanent contraction, or of fibrillar vibration, than of normal contraction; the pulse is accelerated, and the woman is affected with a metritis which renders the labor extremely painful.

3. *Influence of Rheumatism over the Puerperal Functions.*—The reader will anticipate from the foregoing, that rheumatism of the womb may prove a source of difficulty in the delivery of the after-birth, by determining irregular or partial contractions of the organ immediately after the expulsion of the child; but that subject does not claim our attention at the present time, and it will be reverted to hereafter. In the healthy state, the uterus retracts after the delivery, and thereby prevents the development of hemorrhage. But in rheumatism, this retraction of the organ is very imperfect, and it remains much larger than usual; the after-pains are then very distressing, and are prolonged for some time; the uterine vessels are less compressed than usual, and profuse floodings may thence result. On the other hand, the suffering state of the organ diminishes both the lochial discharge and the lacteal secretion; and this, together with the persistence of the abdominal pains, and a manifestation of the phenomena of general reaction, may be mistaken for a peritonitis which does not really exist.

Prognosis.—Rheumatism of the womb is not a disease capable of determining the loss of the mother's life; nevertheless, from the pain that it occasions, and the errors it may give rise to in practice, it does not the less merit a careful study; because, during pregnancy, it may prove to be a source of abortion, and though it is not often manifested until after the sixth month, yet it is always an unfavorable circumstance to the child to be born

before term. We have already spoken of the unfortunate influence it may have over the course and character of the labor-pains; in fact, it has often rendered an artificial delivery imperative. It may also complicate the delivery of the after-birth, and disturb the order of the phenomena that constitute the lying-in. At that period it has often been mistaken for true inflammatory symptoms, and, consequently, has been combated by measures that were more dangerous than useful.

As regards the period of manifestation, it is generally more unfavorable when it occurs at an early stage of the gestation; both because it then has a greater influence over the pregnancy, which has not become firmly established, and because it has a tendency to return several times before term. Besides which, most women, who have been affected during the gravid state, likewise find it to reappear again in the course of parturition, which is thereby rendered laborious.

Treatment.—1st. The measures that have most frequently been attended with success when administered for this disease during the gestation are: general venesection; the intestinal revulsives, such as castor-oil and ipecacuanha; bathing, narcotized lotions over the abdomen, opiated mixtures, and sudorific drinks; and in those cases in which the uterine affection had succeeded the sudden disappearance of a rheumatic pain in some other organ, the application of revulsives over the part primarily affected. 2d. During the labor, the same means are employed; but if they fail, and the degree of dilatation of the os uteri be such as to permit an artificial intervention, either the forceps or version should be resorted to, according to circumstances. 3d. After the delivery, sudorific drinks, opiated unctions over the belly, and baths; and when the lochial discharge has failed, leeches to the vulva, and ipecacuanha combined with opium.

ARTICLE X.

OF DISPLACEMENTS OF THE UTERUS CONSIDERED IN REFERENCE TO THE ACCIDENTS THEY MAY CAUSE DURING PREGNANCY.

§ 1. PROLAPSUS OF THE UTERUS.

We have already seen, in studying the situation of the uterus at the different periods of gestation, that at first this organ sinks lower in the excavation, and that its orifice approaches the vulva. Now this first degree of depression may be considered as physiological, but it cannot pass beyond that without giving rise to some accident or other. Hence, laying aside all causes foreign to pregnancy, the uterus descends the more in the earlier months of gestation in proportion to the larger size of the pelvis, and the greater relaxation of the ligaments. In some women it rests on the floor of the pelvis, whilst in others, the neck, or even the body, may protrude through the vulva and become visible externally.

We see, therefore, that either a simple descent or an incomplete or complete prolapsus may occur during pregnancy, as well as in the non-pregnant condition. The complete prolapsus, that in which the entire body of the uterus is external to the genital parts and hangs between the thighs, is extremely rare. It were wrong, however, to deny its possibility, since this is proved by a case reported by Vimmer.

These displacements may occur either slowly or suddenly, though the female may have had nothing of the kind previously; sometimes, however, they are but the continuation or exaggeration of a pre-existing prolapsus. Although the progressive development of the uterus generally removes the incomplete prolapsus about the fourth or fifth month, by causing the organ to rise above the superior strait, the displacement, in some cases where the pelvis is spacious, may continue, and even increase, notwithstanding the progress of gestation. I have, quite recently, had under care at the Clinique, a very remarkable case of incomplete prolapsus, in which the entire neck of the uterus projected beyond the external parts, the whole excavation being occupied by the lower part of the body distended by the fœtal head. The displacement continued until delivery without any serious accident supervening.[1] It had existed for several years.

[1] The following are some of the details of this interesting case: Marie ——, aged twenty-seven years, entered the hospital October 18th, 1849. She was then at the beginning of the ninth month of her pregnancy. Four years previously, she became pregnant for the first time, and when near delivery, she both felt and saw a small red tumor, of about the size of a walnut, escape through the vulva. It projected but slightly, incommoded the patient but little, and did not interfere with the labor at all, since the latter was accomplished quite rapidly. After her confinement, she continued to feel the same tumor, less prominent, indeed, than during pregnancy, projecting and disappearing according as she was quiet or took long, fatiguing walks. Under the latter circumstances she suffered much from sensations of dragging in the groins and upper part of the thighs. She was habitually and obstinately constipated, and sometimes had great difficulty in urinating.

Two years ago, the same person became pregnant the second time, and during the first three months the tumor became gradually more projecting, and hung very low,—so low, she says, that a midwife, after having returned the parts, applied a pessary, which produced discomfort, and was retained but two days. Eight days after the introduction of the pessary, she miscarried, at about three months and a half to four months. The midwife who attended her could not extract the placenta, and, two days afterwards, a physician endeavored to deliver it, first with the hand, and afterwards with forceps, but could obtain only some fragments.

She recovered entirely; the tumor remaining within whilst quiet in her chamber, but appearing externally after much walking.

Becoming pregnant for the third time, the tumor did not incommode her much more than usual during the first three months, but after the fourth, it projected much more from the vulva, and towards the last three months it was impossible to restore it for several days, even after observing the most absolute repose in bed. At present, the patient being eight months and a half gone, the following may be observed:

A cylindrical tumor, two inches in length, projects from the vulva; it is five inches in circumference, and rather larger and harder at its lower than at its upper extremity. Its external surface is marked at the union of the two upper thirds with the lower one by a whitish circle, dividing two surfaces of different color and appearance. The superior is of a rosy hue and smooth, being only the internal surface of the vagina inverted from above downwards, which thus forms the external surface of the tumor. The inferior portion is of a deeper red color, and presents wrinkles or folds, directed from above downwards, and from within outwards, and separated on the median line by apparently longitudinal fibres. These folds are merely the arbor vitæ of the neck inverted from below upwards, so that the internal surface of the cavity of the neck has become a part of the external surface of the tumor to the extent of five-eighths of an inch. The somewhat swollen lower extremity of this tumor presents an opening, with wrinkled edges, resembling the drawn mouth of a purse, and into which the

In some cases the displacement increases considerably, and either as an effect of its own weight, or in consequence of exertion or violent exercise, the lower part of the body of the uterus projects beyond the vulva, the upper part of the organ being still within the pelvis.

finger enters with ease. This is the cavity of the neck, forming a canal two inches and three-quarters in length, through which the membranes and a hard body, recognized as the head of the fœtus, may be felt. The internal orifice is quite largely dilated, that is, nearly to the size of a one-franc piece. The entire head is discovered to be in the excavation, and altogether behind the symphysis pubis, by which it seems to be arrested.

If it be attempted to enter the vagina, at the same time traversing the circumference of the upper part of the tumor, a cul-de-sac is reached at a depth of from two inches and three-quarters to three inches and a quarter on the sides, from two and a half inches to three inches and a quarter behind, and from only two to two and a half in front, when the examination is stopped by the walls of the urethra, which are thickened and curved, as it were, posteriorly.

This cul-de-sac is formed by the vagina turned inside out from above downwards; and any effort to push it upwards is soon arrested by the fœtal head, which is plunged into the excavation, and rests upon the floor of the pelvis.

The patient suffers from obstinate constipation, and sometimes only from difficulty in passing urine, which escapes by jets.

To recapitulate, we find: 1. A descent of the womb, which seems to be retained in the pelvis only by the floor of the latter, and the pubic arch and symphysis, against which it rests; the rectum and urethra are also compressed. 2. Prolapsus of the neck of the uterus outside of the vulva, carrying with it the vagina, which covers its upper part like the inverted finger of a glove, and which is itself inverted from below upward to the extent of five-eighths of an inch, so that its internal surface forms the external surface of its lower extremity; this extremity of the neck forms the expanded and wrinkled portion of the tumor. 3. Constipation and difficulty in urination caused by pressure.

The tumor increased about three-quarters of an inch in size, from the 20th of October to the 3d of November; but its volume was much greater in consequence of the œdematous condition of the prolapsed parts.

After some fruitless efforts to reduce the prolapsus, I concluded that it would be best not to try any further, but to limit treatment to evacuation of the bowels by mild laxatives, — the patient being unable to receive enemata, — a bath every two or three days, and frequent lotions and injections. Assisted by the horizontal posture, these measures completely relieved the patient of her sufferings.

At noon on the 3d of November, the waters came away without pain, after efforts at defecation. The internal orifice of the cervix was of the size of a one-franc piece; the neck was rather longer than before the 3d, and rather softer. During the last ten days the patient felt her abdomen become harder from time to time, but without experiencing the least pain.

From noon until 10 P. M. the pains were very weak and distant. From 10 o'clock to 3 A. M. (of the 4th), they became greater, more powerful and frequent. Finally, the labor terminated at 3 A. M. the 4th of November, after a labor of fifteen hours, if the time be reckoned from the rupture of the membranes and discharge of the waters, and only of five hours, if counted from 10 P. M., at which time there was no change in either the length or dilatation of the neck, though then it was that the pains became well marked and regular.

The following are the principal phenomena which accompanied the expulsion of the fœtus: At the commencement of labor, the neck remained external precisely as before, and when the head came to be expelled, it dilated visibly, and was the last obstacle which this part had to overcome. No resistance was offered by the vulva, which was traversed before the external orifice of the neck of the uterus.

The disorders resulting from this displacement vary in intensity according to its extent and the stage of pregnancy at which it occurs. When the pelvis is too spacious, the excess of size affecting chiefly the excavation, whilst the straits preserve their normal dimensions, the uterus may remain much longer in the lesser pelvis than is usual in well-formed women. It then incommodes the neighboring parts, pressing upon and irritating the rectum and the bladder; the patient suffers from a feeling of weight at the anus, and painful tractions in the groins, lumbar regions, and umbilicus. A more or less abundant and fetid discharge also comes on; the woman can neither stand nor walk without suffering, and she falls gradually into a state of marasmus.

When the gestation is more advanced, and the womb increased in size, or even if less voluminous, but more depressed, the symptoms, such as complete retention of the urine, very obstinate constipation, &c., are still worse; finally, the pressure of the uterus on other organs may react on itself, and the consequent irritation thus prove a cause of abortion.

When the retention of the urine is complete, either the catheter should be at once resorted to, or the womb be pressed up by one or two fingers previously introduced into the vagina; but even this assistance will not be necessary, if the woman lies down and elevates her hips considerably whenever she wants to urinate. All these symptoms, however, disappear about the fifth month, when the uterus, on account of its great development, can no longer remain in the excavation, and therefore rises above the superior strait.

In cases of simple and incomplete prolapsus, some authors recommend the introduction of a pessary, in order to sustain the uterus, and prevent its prolapsing completely. I regard the pessary as always useless and often dangerous. Rest in bed, and proper cleanliness, seem to me capable of preventing the precipitation of the organ, and of alleviating the painful irritations which the displacement produces.

Certain instances of success seem to authorize attempts at reduction in cases of incomplete and complete prolapsus occurring at an advanced stage of pregnancy. In both circumstances, I think that these attempts should be moderate, since they appear to me likely to compromise the gestation. When the prolapsus is complete, the danger to which the woman is exposed

The child, which was a male, was born alive. Its weight and dimensions were as follows:

Weight,	5½ lbs. (Troy).
Total length,	1 ft. 6 inches.
From the crown to the umbilicus,	9 "
From the umbilicus to the heel,	9 "
Occipto-frontal diameter,	4 "
Occipito-mental "	5 "
Bi-parietal "	3⅝ "
Sub-occipito-bregmatic diameter,	3½ "

The day following the labor, the cervix projected to the same extent outside the vulva, and the parts were rather more flaccid; the engorgement being dissipated, the neck was returned within the vagina; the patient continued in the horizontal position, and a month after left the Clinique without the neck having appeared at the vulvar opening.

by the nature of the displacement itself would certainly authorize rather greater perseverance; but it is easy to see that in the latter months it will rarely be possible to return the uterus within the pelvis.

When the reduction is impossible, the uterine tumor should be supported by a proper bandage, and the female confined to the horizontal position.

In women who have had a falling of the womb before impregnation, there is reason to fear that it may persist and augment during the first three or four months of gestation, in consequence of the great laxity of the ligaments; and it is therefore prudent to advise such persons to keep the horizontal position during all this time, and not to permit them to get up until after the fifth month. After the delivery, they should again remain in bed six weeks or two months at least; for by such precautions, not only may the patient escape the dangers attendant on a prolapsus uteri during the earlier periods, but sometimes even a radical cure of the disease she had before the gestation took place may be effected.

§ 2. Retroversion.

The mobility of the uterus in the pelvis, which is still observable in the early stages of pregnancy, notwithstanding its augmentation in volume, exposes it to another variety of displacement, that is not so common as the preceding, but more disastrous in its consequences. Thus, in some instances, the womb seems to execute a see-saw movement, by which its long vertical axis is brought into a nearly horizontal line in the excavation, in such a way that the fundus remains either a little more elevated, or else somewhat more depressed than the neck. This displacement is called *retroversion*, when the fundus uteri is carried backwards into the hollow of the sacrum, and *anteversion*, when it is directed towards the symphysis pubis. These two varieties may occur in different degrees; but the displacement will be much more considerable in retroversion than in anteversion, on account of the anterior concavity of the sacrum; the former is also more frequent and serious than the latter.

Finally, in the latter part of gestation, the uterus may incline more or less to the right or the left, so as to constitute what have been termed lateral obliquities.

[If we may credit M. Salmon (of Chartres), who has published an excellent thesis for the "Concours" on the subject, retroversion of the uterus during pregnancy is not a very uncommon occurrence. Having already met three cases in our own practice, we are the more ready to accept his opinion as probably correct. It usually happens between the third and fourth months, and is rare before the third and after the fifth months. The observed cases occurred much more frequently in those who had already borne children, than in those who were pregnant for the first time.

As the displacement may be gradual or sudden, we may describe it according to its character in these respects.

The causes of gradual retroversion are: the normal inclination of the fundus of the womb toward the hollow of the sacrum in early pregnancy; the more rapid development of its posterior surface at the same period; a spacious pelvis, as insisted on by M. Chailly; the constant pressure upon the fundus by the abdominal viscera; and above all, a collection of fæces in the sigmoid flexure, of the colon, and retention of urine. Numerous discussions have taken place in regard to the effect

of retention of urine in the production of this displacement, some thinking that the retention is an effect and not the cause, whilst others believe that distention of the bladder, so far from producing, would actually prevent the occurrence of retroversion. We agree with those who regard retention of urine as the principal cause of the gradual displacement, basing our opinion upon the fact that, by frequent emptying of the bladder by the catheter, the displacement will be spontaneously removed. As other causes of this occurrence during pregnancy, we have noted a previous retroversion,[1] the growth of abdominal tumors and adhesions resulting from an old peritonitis, &c.]

When the retroversion occurs suddenly, it is produced by the same mechanism, only a more vigorous and energetic impulsion is then requisite; and such an impulsion is usually given by a rapid, violent contraction of the muscles: thus, after a severe retching, or vomiting, or after the strainings at stool, in women who are habitually constipated, or in urinating, in cases of retention, the womb is often found displaced.

M. Moreau relates an instance of a woman who lifted a weight of fifty pounds, for the purpose of placing it on the balance, when she was immediately attacked by pains in the hypogastrium, vomiting, syncope, &c. On his arrival, he found the uterus completely turned backwards; but all these symptoms disappeared immediately after the reduction was effected. A fall backwards, or blows, or a strong pressure below the navel, have very frequently caused the same result. (Nægèle.) In one of Hunter's cases, the retroversion appeared soon after a severe fright.

"A woman," says M. Martin, of Lyons, "was taken in her third month, after a violent straining effort, with pains, accompanied by loss of blood; at first, the os tincæ was found in the *centre* of the vagina; but the patient renewed her efforts, and then the uterus became completely retroverted, that is, the neck was placed behind the pubis and a little to the right, and the fundus of the organ rested against the sacrum. In this instance the retroversion evidently resulted from the conjoint influence of the uterine contractions and the expulsory efforts of the abdominal muscles." (Martin, *Mémoires*, p. 142.)

Where the displacement is effected slowly, the woman is but little incommoded at first; and the necessity for reduction is only apparent after it has become considerable. Originally, there are only some painful dragging sensations in the groins and lumbar region; a feeling of weight and pressure on the neck of the bladder; some vesical tenesmus, and a little difficulty in the emission of urine. But when the uterus attains a certain degree of development, all these phenomena increase, and we are then obliged to interpose the resources of our art; for when matters reach this state, the womb becomes wedged, as it were, in the middle of the pelvis, and even more firmly so afterwards, because its volume augments rapidly; for not only does the fœtus continue its growth, but also the uterine walls become engorged, tumefied, and inflamed, and the symptoms caused by this inflammation are added to those previously existing; and, further, as the space then occupied and filled up by the uterus is larger than the superior strait, the reduction becomes very difficult, or even impossible. Hunter relates a case in which the reduction could not be made, and the woman

[1] According to Tyler Smith, retroversion, in the great majority of cases observed in pregnancy, has its origin in a previously retroverted or retroflexed uterus.

died in consequence; and at the autopsical examination it was found necessary to cut through the symphysis, in order to disengage the womb from the excavation.

When the displacement takes place suddenly, all these symptoms are speedily manifested, and should it happen at an early stage, they are shortly carried to the highest degree, or even may soon prove fatal, for their persistence may give rise to so great a distention of the bladder, as to produce its rupture.[1] Again, the accumulation of fecal matters in the intestine occasions so imperious a feeling of tenesmus, that the female gives way to the most immoderate strainings; and the pain caused by the displaced and inflamed uterus may create a convulsive agitation of the abdominal muscles and the vaginal walls, so great as to cause a rupture of the vagina, and an escape of the fundus of the uterus from the vulva; as happened in the case communicated to M. Dubois, by M. Mayor.

["Palpation of the abdomen," says M. Salmon, "is usually the first thing resorted to by physicians when called to a case of retroversion. The patients generally both know and say that they are pregnant, so that when the abdomen is examined in order to ascertain the cause of suffering, a large tumor reaching from the pubis to the umbilicus is almost always detected. This tumor is superficial, fluctuating, and dull upon percussion. It may bear no inconsiderable resemblance to the uterine globe, especially should it harden at intervals, as in one case which came under our notice. That the tumor is formed by a greatly distended bladder, is proved by the use of the catheter: it is important, however, not to be deceived by the statements of patients, who often believe that the bladder is empty because they are able to discharge a small quantity of water.

"Palpation of the abdomen is also useful in those rare cases unaccompanied by a distended bladder; for here the displacement of the uterus is indicated by the impossibility of detecting the fundus of the organ on a level with or below the superior strait of the pelvis." (Salmon.)]

The vaginal examination, in such cases, will enable us to detect the particular variety of displacement which causes the symptoms, for the finger encounters a tumor just within the vagina that fills the whole excavation, which is the posterior surface of the womb. In passing over this surface, which is of greater or less extent according to the stage of pregnancy, the finger reaches the fundus of the uterus, which it finds directed toward the anterior surface of the sacrum, and in more serious cases toward the point of the coccyx. Pursuing the examination anteriorly, the neck is discovered to be turned directly forward, toward the middle of the posterior surface of the pubis, and sometimes even raised above the upper edge of the symphysis. The displacement may indeed be so great that the axis of the organ is almost completely overturned and the finger cannot reach the

[1] The greatly distended bladder may then doubtless form a very considerable tumor, capable of increasing the retroversion mechanically, and of opposing the reduction. But the very intimate adhesions, by which the anterior and posterior surfaces of the uterus are connected with the posterior and inferior walls of the bladder, tend especially to augment the difficulties. The abnormal size of the latter organ keeps it very high in the pelvis, and the neck of the uterus evidently can only be brought downwards and backwards, after the relieved bladder has itself descended into the excavation.

external orifice. Sometimes, however, the neck is very accessible to the touch, although the retroversion is carried to the greatest extent. This is owing to the fact of the cervix being bent round on the body, like the beak of a retort. In this case, the uterus was retroflexed before being overset backward.

In retroversion, a rounded tumor, varying in size with the volume of the displaced organ, is found in the vagina. This tumor spreads out more behind than in front, whereby the posterior vaginal wall is depressed, whilst the anterior is distended and elevated. Sometimes the perineum is prominent, and the vulva swollen, the rectum is pressed down and almost obliterated by the tumefied organ, and the anus often dilated and bulged outwards.

[Unpleasant to the patient as is examination by the rectum, it must be had recourse to when the indications derived from the above described measures lead one not merely to suspect, but to feel certain that the retroversion exists. It is the only method by which the uterine tumor can be explored over a considerable extent of surface, as there is nothing to prevent the finger from passing deeply behind it. Another advantage is, that whilst the vaginal touch enables us to appreciate better the position of the cervix at the bottom of the long cul-de-sac, behind the pubis, examination by the rectum affords precise knowledge of the character of the tumor formed by the fundus of the womb. (Salmon.)]

A particular variety of retroversion has been described by M. Martin, of Lyons, in which the os tincæ protrudes from the vulva, and the fundus uteri is pushed to the side of the sacrum; the uterine neck, being curved like the spout of a ewer, is situated below and a little in front of the pubis; the body of the organ is retained in the sacral excavation, and lies close to the perineum. But, after carefully reading his description, I do not think it can be justly considered as a new example of retroversion. I believe it was merely a falling of the womb, which had existed prior to pregnancy and had been aggravated by this latter condition; there was at the same time an anteflexion of the neck, which explains how the curve in the latter described by M. Martin, might be formed below and in front of the pubis from the depressed body forcing it beyond the vulva.

A retroversion could scarcely be confounded with simple prolapsus; for, in the former, the vaginal wall is always situated between the finger and the tumor, and the neck is high up behind the pubis, whilst, in a prolapsus, the cervix is always the most dependent part, and the tumor can be perfectly isolated from the vagina; in the latter case, the reduction is generally easy, but it is usually quite difficult, sometimes even impossible, in the former. Further, the symptoms of retroversion are ordinarily much more severe than those of prolapsus.

[Without going into any detail on the subject, we would point out the possibility of mistaking a retroverted pregnant uterus for an intra-uterine fibrous tumor, abdominal tumors, or tumors of the cavity of the pelvis. The differential diagnosis between the unimpregnated uterus when retroverted and the same organ when similarly displaced during pregnancy may also prove somewhat difficult; still, the fact of the case may be generally arrived at by judging carefully of the size of the womb, and interrogating the patients in regard to the time of the last

menstrual flow. It would be easier to make a mistake in cases of extra-uterine pregnancy developed in the utero-rectal cul-de-sac, or of retro-uterine hematocele; in this case, however, the entire uterus is crowded out of position without being tilted, and it is often easy to feel its contour above the margin of the pubis.]

As a general rule, the prognosis in these displacements is very grave; it varies, however, with the period of pregnancy, the volume of the uterus, the alteration in the neighboring parts, and the violence of the attendant symptoms.

Cæteris paribus, a retroversion is usually more unfavorable than an anteversion; because, in retroversion, the constipation and retention of urine, which thus far have been considered as comparatively unimportant, soon become aggravating circumstances of the disease. In fact, the bladder can only enlarge and ascend into the abdominal cavity, by pushing the uterine neck upwards and towards the front; and hence, its body acting on the uterus by its size and weight, necessarily increases the displacement. The stercoraceous matters accumulated in the rectum, above the part in contact with the fundus uteri, act in a similar manner; and, again, all the woman's expulsory efforts have a constant tendency to further depress the fundus, after the displacement has once commenced. In anteversion, on the contrary, all the causes just enumerated operate in a favorable manner. Thus, the distended bladder constantly has a tendency to press back the body of the womb, which is then carried forwards, and the accumulated matters of the large intestine, pressing from above downwards on the posterior part of the neck, contribute to the same end.

[Sudden retroversion is more threatening in appearance than the gradual form. Both cases are serious in proportion as the pregnancy is in a more advanced stage, because the accidents which are liable to occur and the difficulty of reduction, increase with the size of the uterus. Independently of the accidental or gradual cause which produced it, and of the period of gestation at which it occurred, the danger, says M. Salmon, is in proportion to the importance acquired by one of the principal phenomena of the affection, viz., retention of urine. If the latter be complete, the symptoms become urgent in seven or eight hours, but if incomplete, the displacement may continue for fifteen, twenty, or twenty-five days without causing any serious results.

Retroversion generally terminates in recovery, though it may give rise to abortion. In some cases death may ensue from peritonitis, beside which rupture or gangrene of the bladder, or rupture of the uterus or its partial destruction by gangrene, may be apprehended.

Treatment.—In the first place the bladder must be emptied, as in its distended condition it would interfere with the attempts at reduction. It sometimes happens, indeed, that after the urine is withdrawn, reduction occurs spontaneously. Many practitioners have very justly insisted upon the advantage of catheterism repeated several times daily through the course of several days, as the only method of treatment; it has very often proved successful, insomuch that Burns felt authorized to say that retroversion would rarely last over a week, if the bladder were emptied three or four times a day. It is a course, therefore, which may be followed whenever the symptoms are not urgent.]

Treatment.—After having emptied the bladder and rectum, and combated the inflammatory symptoms by the appropriate means, the accoucheur should proceed at once to reduce the uterus to its natural position, and secure it

there. The best position for the female to assume is one in which all the muscles are thrown into a state of relaxation; two fingers are then to be introduced into the vagina, with which the body is first to be pushed up, after which the index should be hooked over the neck so as to depress it.

The reduction may sometimes be effected on a single trial, but usually we are compelled to repeat the attempt after an interval of a few minutes; and just at the instant of the resumption of its ordinary position by the womb, a noise is heard, in some instances, like the click of a spring. It must not be supposed, however, that this operation is always an easy one. For the difficulty in using the catheter, so often experienced, the impossibility of emptying the rectum, and especially the voluminous tumor formed behind the uterus by the fæces collecting in the sigmoid flexure of the colon, the violent strainings made by the patient under such circumstances, and the size of the tumor, and its adhesions to surrounding parts, are so many embarrassing circumstances to the practitioner. Although it is very seldom that we cannot succeed in introducing the catheter, by time and patience, yet in some cases this has been found altogether impossible; indeed, much prudence is requisite in the measures then adopted, and if they all prove useless, a moderate pressure made over the hypogastrium may, perhaps, slowly compress the bladder, and thus make the woman urinate, so to speak, by disengorgement.

The retroverted fundus sometimes compresses the rectum to such a degree that an injection cannot be made to enter the large intestine.

Such cases demand some precaution in the administration of the enemata. There may be a collection of indurated matters above the fundus of the retroverted uterus, in which case it is evident, that, as the latter compresses the upper part of the rectum, an injection given in the usual manner cannot reach high enough to bring away the fæces accumulated in the descending colon. It then becomes necessary to use a long gum-elastic tube, which may be inserted to the extent of seven or eight inches. This simple expedient has often disencumbered the intestine of matters which an ordinary injection could not have reached, with the effect of producing spontaneous reduction.

Even with the use of the tube just recommended, the injections are sometimes ineffectual. In such cases, if the palpation and the abdominal percussion lead us to suspect a considerable accumulation of fecal matters in the descending colon, we should exhibit purgatives by the mouth. Again, the necessary introduction of the hand into the vagina, to effect the reduction, is at times so painful to the female, that, notwithstanding all persuasions to the contrary, she gives way to the most violent bearing-down efforts, which neutralize those of the operator. If baths, or emollient and narcotic injections, should not assuage this acute sensibility, the advice of Dewees might be taken, and bleeding practised to the extent of producing syncope; still better, in my opinion, would be the administration of chloroform before the operation.

The abnormal adhesions that are occasionally established between the uterus and adjacent parts, will certainly add another to the serious difficulties just mentioned; but even this should not give rise to despair. Amussat reports a case where he distinctly felt some bridles in the bottom of the

vagina, and to the left of the tumor, into which he could ho k the forefinger, but after a careful examination he acquired the conviction that the uterus was free on the right side. He then renewed his attempts, by acting in such a way as to turn the uterus from the opposite side towards that where the adhesions existed; that is, from right to left, and he thereby succeeded in replacing the organ in its natural position. But if, after having adopted all suitable precautions, the simple procedure just described should not succeed, one of the following plans should then be resorted to, namely, to act simultaneously by the vagina and rectum, as some have advised; but the most simple plan, however, is that of M. Evrat, quoted by M. Moreau, as follows: The woman must lie upon her side, and the accoucheur then takes a rod eight or ten inches long, covered at one end by a tampon of linen smeared over with some fatty matter, which he introduces into the rectum so as to press, through the recto-vaginal septum, the fundus uteri from below upwards, whilst the two fingers passed into the vagina hook the neck, and simultaneously draw it downwards and backwards. The force necessary for this reduction is very variable, though in effecting it we need not be restrained by the fear of producing an abortion; for, even if this were to result from such efforts, the dangers to the mother would be far less than from the continuance of the retroversion. In a case of this kind, M. Halpin, after having emptied the bladder, and endeavored unsuccessfully to reduce the uterus, came to the conclusion that the only mode of curing the patient was by the employment of an instrument that would bear equally on all parts of the displaced womb; and he imagined that the pelvis could be filled up with a bladder, and thus all the contained organs be pressed up together into the abdomen. With this view, he placed an empty one between the fundus uteri and the rectum, and then by cautiously distending it, he actually succeeded in pushing the fundus upwards.

Attributing, as they did, the difficulty of reduction to the pressure of the viscera upon the anterior surface of the uterus, Hunter, Boyer, and others, have recommended that the patient should be placed in such a position that the weight of the intestines may be supported by the upper part of the abdomen. Acting upon this suggestion, M. Godefroy adopts the following position: the patient rests her head and hands upon the floor, whilst the anterior part of the thighs and legs repose upon the edge of the bed, where they are supported by assistants. The surgeon then acts either through the vagina or the rectum upon the fundus of the uterus in such a way as to effect the reduction. In three very grave cases, success was complete. (*Journ. des Conn. Méd. Chir.*, August, 1846.)

This position is very fatiguing, painful, and disagreeable to the patient. I would, therefore, much prefer, in these difficult cases, simply to place the female on her knees in bed, with the upper part of the body supported on the elbows. I have thus been able, in two cases, to reduce retroflexions which had resisted every other means.

In an obstinate case, we might resort to a procedure recently employed by Amussat, with a prospect of success: that is, to place the female in the position for operating for stone, and then introduce one or two fingers into the rectum, and gently press up the uterine tumor, by following the con-

cavity of the sacrum, at first directly upwards, and then alternating from right to left and left to right, so as to raise the whole surface of the uterus; but if the finger or fingers placed in the rectum cannot reach so high, the thumb should be put into the vagina so as to elevate the perineum, in order that the former may penetrate still further; and, lastly, to get higher yet, an assistant might press against the elbow, or the accoucheur himself could sustain it with his own thigh or body. M. Amussat declares that he has twice succeeded in this manner in making a reduction that had previously been ineffectually tried by several other practitioners.

Finally, what is to be done where the reduction is impossible? Abandon the patient to the resources of nature, says Merriman; but would not that devote her to a certain death, in case the inflammatory phenomena did not determine an abortion? And since a miscarriage is inevitable under the most fortunate circumstances, would it not be advisable to bring it on, rather than to leave the patient exposed for a long time to the dangers which threaten her? Indeed, most physicians are of this opinion, and I should not hesitate, therefore, to rupture the membranes by a sound passed through the neck of the womb. But, sometimes, the neck is so high up that it is wholly inaccessible; and then a puncture of the uterus itself must be resorted to. This latter operation has been performed both by the vagina and by the rectum, but I should think the first preferable. It is, without doubt, the last resource, but always ought to be chosen rather than the symphysiotomy recommended by Gardien and some other accoucheurs.

After the reduction (when that has been possible), the patient must remain in the horizontal position until towards the sixth month of pregnancy, and must carefully avoid all straining, whether in urinating or at stool. These simple precautions are all-sufficient, and generally render the introduction of a pessary useless; which latter, however, Baudelocque considers indispensable in most cases. Occasionally, the incontinence of urine, brought on by the pressure which the neck of the bladder has suffered from the neck or fundus uteri, may still continue some time after the reduction; and then, if the ordinary simple means do not cause its disappearance, we may resort to the warm mineral waters of Cauterets, Barèges, or Balaruc; to frictions with the tincture of cantharides, and blisters on the hypogastrium, together with tonics and astringents administered internally.

§ 3. Anteversion.

Anteversion is very rare in the early stages of gestation, and, probably on this account, has been passed over by most authors who have studied the disorders of pregnancy. The manner in which the uterus is developed, the peculiar form of the anterior and posterior boundaries of the pelvis, and the normal direction of the organ, are so many circumstances which, just in proportion as they facilitate retroversion, render the occurrence of anteversion difficult. Besides, the influence which a distended rectum and bladder have in the production and increase of the posterior displacement, would tend to restore the womb to its natural position, should any circumstance effect a commencement of anteversion.

Notwithstanding these favorable conditions, anteversion has been observed

by Chopart at two months, by Madame Boivin at three months, and finally by Ashwell. The case of the latter being unknown in France, we shall give an analysis of it. I have myself twice detected it at two months in cases of women affected with incorrigible vomiting.

Mrs. M——, thirty-three years of age, and habitually very constipated, fell, during the first month of her pregnancy, whilst descending a pair of stairs. Though there was no hemorrhage, she had a spell of faintness which lasted nearly an hour. For five or six weeks there was a feeling of weight at the pubis, micturition was frequent and painful, but there was no obstruction to defecation. I examined her for the first time at the end of the second month. The cervix was in its normal position, but the strongly-inclined fundus formed a round solid tumor between the bladder and the anterior part of the vagina. Pressure with the finger upon the angle of inflexion caused pain. The neck was elongated, and larger and harder than usual. I endeavored, ineffectually, to effect reduction by pressing upon the fundus of the womb with the finger, whilst the neck was drawn downward and forward by the index of the right hand. At the sixth month, the husband found that the anteflexion had almost entirely disappeared, and although the lady still suffered some pain in the latter months, she was delivered without difficulty.

Although the author describes this as a case of anteflexion, it is evident that there was also anteversion, as is proved by the normal position of the neck, and especially by the spontaneous disappearance of the displacement at the fourth month. I see, indeed, no reason why an anteflexion should disappear suddenly at this stage of pregnancy.

Anteversion is, therefore, possible in the early months, though it occurs more frequently in the second half, and especially towards the end of the pregnancy. At that time, the fundus of the womb, which is naturally inclined forwards, is supported by the abdominal muscles only; now if these resist slightly, as often happens when women have had several children, the physiological inclination has a constant tendency to increase. The axis of the uterus may thus become nearly horizontal, or even be depressed still lower, until the fundus falls upon the thighs and knees. The neck, which is carried very far upwards and backwards, sometimes gets above the sacro-vertebral angle, and is reached by the finger with the greatest difficulty; the impossibility of attaining it has occasionally given rise to a belief of the existence of imperforation.

Beside the signs furnished by the touch and examination of the abdomen, some functional disorders may be produced by anteversion at different stages of pregnancy, whose cause should not be mistaken when called upon to treat them. In the early months, the sensation as of a heavy weight at the pubis, frequent and sometimes painful micturition and defecation, are almost the only rational signs. In the latter months, the weight of the uterine tumor, which is carried strongly forwards, occasions pains and draggings in the thighs and groins; the extreme distention of the skin of the abdomen, also, produces acute pain, and the pressure to which the bladder is subjected is the cause of vesical tenesmus, with dysuria or strangury. Finally, in the worst cases, walking is rendered difficult and often impossible.

The prognosis is not generally serious; for, when the anteversion occurs in the early months, the development of the uterus may restore it; when it occurs in the second half of gestation, it may produce premature labor, though it usually occasions merely the inconveniences just spoken of, and never gives rise to accidents in any degree serious, except during labor. (See *Dystocia.*)

Reduction may be attempted in the early months, but has hitherto always failed; too great perseverance would be at the risk of abortion. The most prudent course, therefore, provided resistance is encountered, is to intrust the reduction to the subsequent progress of the pregnancy. If the discomfort and weight are too fatiguing, they may be relieved by the horizontal decubitus.

At a more advanced stage, a body bandage, or a sort of corset or belt for the abdomen, well adapted to the size and form of the belly, will afford much relief. When the abdomen is pendent, the abdominal belt may be kept up by suspenders.

§ 4. Lateral Obliquities.

In describing the physiological phenomena of pregnancy, we spoke of obliquities of the uterus, and pointed out their probable causes. They are rarely carried to any great extent, and are never the occasion of serious accidents. Only by tending to produce an unfavorable presentation of the child, and by retarding the dilatation of the neck, can they have any unpleasant effect upon the labor. Therefore, the present is not the proper time to speak of them further.

CHAPTER III.

DISEASES OF THE OVUM.

ARTICLE I.

DROPSIES.

§ 1. Dropsy of the Amnion, (*Hydramnios.*)

The amniotic liquid may sometimes augment to a very considerable quantity; but, as the normal amount is very variable, it is difficult to say above what limits it should be considered as a disease; however, when it exceeds three or four pounds, the accumulation may be justly attributed to some morbid condition.

In the present state of our science, it would be absolutely impossible to designate the cause of this singular affection, although some facts seem to militate in favor of its being produced by an inflammation of the amnion; but this opinion requires further confirmation to be received without hesitation, for, notwithstanding Dr. Mercier claims to have seen the internal surface of the amnion covered several times by false membranes, and the membrane itself highly injected, yet other observers have not detected anything of the kind. (*Journ. Gén. de Méd.*, tom. xiv.)

Again, from the cases cited by Drs. Merriman and Lee, it would appear

that a dropsy of the amnion is often associated with a morbid condition or a bad conformation of the fœtus, or with a state of general infiltration on the part of the mother; indeed, some facts would lead to the supposition that constitutional syphilis predisposes to this disease.

In a few instances, it has seemed referable to sanguineous plethora; but as it occurs in women of every variety of condition, constitution, and age, this cannot be considered as a fixed rule on this point. It is much more frequent in twin pregnancies, and rarely supervenes prior to the fifth month.

In some cases, the dropsy is preceded by all the signs of an active inflammation; but most commonly a dull pain in the uterus, a feeling of weight about the pelvis, and a rapid growth of the organ, are the only evidences of its existence. The womb speedily acquires a considerable volume, and is more distended at the fifth or sixth month than it usually is at term. Further, the development is proportionate to the quantity of liquid: thus, the latter often amounts to five or six pints; and Baudelocque reports a case in which thirteen pints escaped from the uterus, and another one of thirty-two pints. Certain authors have even known forty or fifty pints to exist in the amniotic cavity. The fluid is similar in all respects to the liquor amnii.

The uterus rarely becomes much enlarged without disturbing the functions of the thoracic organs in the manner heretofore described, and facts are not wanting to prove that it may even produce asphyxia.

In a case reported by Duclos, the distention of the womb was so great, although the gestation had only advanced to the seventh month, that it enlarged the abdomen beyond measure, pushed up the diaphragm, and interfered so much with the respiration and circulation that the woman's life seemed to be seriously compromised.

The physicians, called in consultation, decided in favor of bringing on the uterine contractions as soon as the neck showed any evidence of dilatation; but, suffocation being imminent, M. Duclos ruptured the membranes, at first permitting a certain quantity of fluid to escape, then, by keeping his fingers in the neck, he prevented its complete evacuation; and thus, for four times, after intervals of fifteen minutes each, he allowed a further flow, while slight pressure was made over the abdomen. In this manner, fourteen pounds were collected, without counting what was lost. The symptoms disappeared immediately, but as the uterus did not appear capable of any effort, and the neck offering no resistance, it was easily dilated, and a living infant brought away by the forceps. The child was feeble and diminutive, and its limbs were very small. The mother recovered.

M. Evrat, Sen., of Lyons, has published several cases of almost complete asphyxia (lividity of features, cessation of pulse and respiration), in which the women were rapidly restored by the puncture of the membranes and discharge of a large amount of water.

A premature distention of the uterus by amniotic dropsy, to the size which it usually has at the end of gestation, is capable of producing dangerous symptoms. It is astonishing, as Scarpa remarks, that in cases of dropsy complicating pregnancy, the womb should occasion symptoms of suffocation which it never determines at the end of the ninth month, though

its size be the same. It is explained by the sudden and rapid development in the first case; whilst in the latter the distention takes place almost imperceptibly, the walls of the abdomen yield gradually, thus allowing the uterus to project more in front, so as to diminish its elevation slightly, whilst it crowds much less upon the diaphragm.

As before said, ascites often coexists with the amniotic dropsy; but as the two diseases may occur separately, it becomes important to establish their differential diagnosis.

In ascites complicating pregnancy, the urine is small in quantity, whitish, and turbid, the thirst great and constant, and the lower extremities and genital parts mostly much infiltrated. It is difficult and sometimes even impossible to distinguish the shape and fundus of the uterus, on account of the irregular form of the belly, and the enormous distention of the hypochondriac regions. Percussion produces an undulation, or sort of fluctuation, which is much more perceptible at the upper than at the lower part of the abdomen.

In dropsy of the amnion, the size of the belly approaches much more nearly that of a uterus at term, although the pregnancy may not have existed more than five or six months. The uterus is so rounded as to be almost spherical. Fluctuation is more obscure, thirst slight or absent, urine natural, and in some cases little or no infiltration of the lower extremities. The umbilical tumor is rarely present, and, when it exists, has not the transparency observed in ascites.

The great enlargement of the womb often provokes premature contractions and abortion. Sometimes the child is born living, but so little developed that it cannot survive; more frequently, it dies in the mother's womb, and is not expelled until some time after.

Dropsy of the amnios, which is so grave as regards the infant, rarely compromises the mother's life, or even her health. Some unfortunate cases have, however, proved fatal, though generally she is merely incommoded by the excessive volume of the womb, and the consequent interference with other organs. The expulsion of the liquid is generally spontaneous; the fœtus, membranes, and placenta passing away with the waters; whence, the cause no longer existing, the disease is completely cured.

According to some authors, the rupture of the membranes and consequent expulsion of the fluid is not always followed by the birth of the child. In this case, the breach in the membranes takes place at a point considerably above the neck, the uterus is relieved slowly of the superabundant fluid, and the pregnancy proceeds with no other accident than a more or less frequent discharge of water. I think that, in most of these cases, an accumulation of fluid between the membranes and the uterus, as in the hydrorrhœa to be spoken of hereafter, has been mistaken for amniotic dropsy. I confess, however, that the following case, carefully observed by Ingleby, leaves hardly a doubt as to the possibility of the fact: A lady, six months gone in her third pregnancy, lost suddenly a large quantity of water during the night. From this moment, until the termination of pregnancy, there escaped every two or three days a pint and a quarter of fluid. The woman was delivered of a large boy. The after-birth was expelled spontaneously. I received it in

my hand, says the author, so as to avoid laceration of the membranes. I examined it with the greatest care, and discovered, besides the opening made by the head in the centre of the membranes, a second opening, of circular form, near the edge of the placenta. It was doubtless through the latter that the fluid escaped from time to time.

It is proved, by many observations, that amniotic dropsy frequently recurs in the subsequent pregnancies of the same female.

A remarkable circumstance, pointed out by MM. Bunsen and Kill, and one instance of which has come under my own notice, is a dropsical condition of the fœtus, it being sometimes affected with hydrocephalus, and at others with ascites.

The same authors also mention having observed that in these cases the placenta was often remarkably large. Thus, in a case reported by M. Kill, in which the extreme distention of the uterus produced abortion at the sixth month, the circumference of the placenta was a third larger, and its thickness double that of ordinary placentas. It was pale, and its tissue spongy, and, when divided, the vessels traversing its substance were found to have almost the size of the arteries and umbilical vein.

The abdomen of the fœtus contained a large amount of fluid. The liver was voluminous, occupying almost the whole abdominal cavity. Its structure was normal, without any indication of swelling, but its vessels were highly developed.

This great size of the liver is supposed by the authors quoted to be connected with the extreme development of the placenta, whose enlarged vessels would of course supply a great quantity of blood to the umbilical vein. (Churchill, page 50.)

When the malady is once established, it is exceeding difficult to find the proper remedies, — I will not say to cure, but even to impede its course; — for instance, diuretics have usually proved of little value. Some authors, indeed, seem to have observed good effects from dry diet; and Burns specially recommends cold bathing. But, in spite of all we can do, the affection ordinarily goes on increasing until the commencement of labor; and in the greater number of cases there is nothing to be done except to await this event. However, if the uterine tumor be of excessive size, more especially should the dropsy of the amnion be complicated with ascites and a general infiltration, and the patient's life be endangered by the obstructions to the hæmatosis, an evacuation of the waters should be determined upon by rupturing the membranes.

The puncture is usually effected by the use of a male or female catheter, or a stylet, which is introduced through the neck, and the membranes perforated with its extremity. When the cervix is sufficiently dilated, the rupture may be performed with the finger. When not obliged to act quickly, contractions may be previously solicited by introducing and leaving a piece of prepared sponge in the cavity of the cervix, or by practising some douches upon the inferior segment of the uterus. (See *Premature Artificial Delivery.*) But should the gravity of the symptoms demand immediate intervention, there would, I think, be some advantage in following the advice of M. Guillemot, and to glide the catheter between the ovum and the uterus, so as

to pierce the membrane far above the neck; this process would permit the discharge of the fluid to be controlled, and only the superabundance, so to speak, to be withdrawn. The pregnancy may afterward be left to itself.

In case of complete obliteration of the neck, paracentesis by the vagina and in the vicinity of the uterine orifice must be performed. Scarpa and Camper recommend puncturing between the umbilicus and pubis. In one of the observations of Evrat, Sen., the operation was practised in the place, so called, of election, for paracentesis. The patient was delivered eight days afterward of two living children, and recovered perfectly. The details given by the author do not inform us whether the case was one of ascites, or really of amniotic dropsy, as he thought.

The vaginal puncture seems to me likely to subject both mother and child to the fewest risks, whenever the neck is inaccessible.

§ 2. HYDRORRHŒA, (*Hydrorrhœa gravidarum.*)

The Germans have given this name to those discharges of water that occur in the course of the gestation, but which, in general, are neither preceded nor followed by any uterine contractions; their nature is such as to interfere but slightly with the pregnancy, the latter advancing as usual to term, and at the accouchement the bag of waters is regularly formed.

This affection is quite common in the latter months, but very rare at the beginning of gestation. I observed it once between the third and fourth month, and it reappeared but once during the remainder of the pregnancy, which terminated happily. (See *Abortion*, article DIAGNOSIS.)

The frequency of such discharges, and the quantity of water lost each time, are exceedingly variable in different cases. Sometimes the liquid comes away in gushes, at others drop by drop; but the amount may increase in an incredible manner, and the loss may occur but once, or be renewed frequently. Further, the intervals of its appearance are very irregular, and lasting a long time when it does come on, during which any mental emotions or bodily excitement singularly influence the profuseness of the discharge. On the other hand, it augments in quantity during the most perfect quietude, as, for instance, at night during sleep; its cause can rarely be ascertained.

Most generally, the female enjoys her usual health before the discharge comes on, when she unexpectedly finds herself wet, the fluid escaping drop after drop, or else she hears the peculiar sound caused by the sudden irruption of a considerable quantity of the waters. In most cases, she suffers no pain either pending or after this discharge; though it may happen that a too rapid depletion of the uterus, and the consequent parietal retraction, may bring on some slight uterine contractions; but if the patient then keeps perfectly still, they soon disappear, and everything resumes its natural order. In color, the discharged water is usually a little yellowish, very limpid, and at times tinged with blood, leaving stains upon the linen, and having a well-marked spermatic odor.

Should the hydrorrhœa be attended with the uterine pains, it would be an evidence of an approaching abortion; and some accoucheurs, supposing the membranes had been ruptured, have been known, under such circumstances, to use every effort to accelerate and to terminate a labor which

really had not commenced, and which, without their interference, would not have occurred before the ordinary period.

[We saw a case of hydrorrhœa during the sixth month of gestation, in which uterine contractions had come on and almost completely effaced the neck of the womb which was opened to the size of about a franc-piece. Rest in bed and opiate injections quieted the threatenings of abortion, and the patient was delivered at term.]

This error may be avoided by attending to the fact, that, notwithstanding so considerable a flow of liquid, the size of the uterus, its consistency and elasticity, are such as it generally presents at that period. These remarks will at least be sufficient to excite a doubt as to the true source of the waters; and from the moment that there is a doubt, every effort should be made to prevent and not to hasten abortion.

These fluids, although having no relation in their seat to the liquor amnii, have, however, been called the *false waters*, so as to distinguish them from those which escape after the membranes are ruptured in labor.

Various opinions have been advanced as to the nature and seat of these false waters; thus, certain accoucheurs have supposed that they were contained between the chorion and the amnion, and that their escape is due to a laceration of the chorion; others, that they are owing to the rupture of an hydatid, lodged either in the cavity or the neck of the uterus (Bœhmer, Rœderer). Again, Baudelocque was of the opinion that it resulted from the transudation of the liquor amnii through the membranes. Some others explain it by invoking an œdematous condition and an infiltration of the uterine cellular tissue. It is an easy matter to refute all these opinions by recalling the fact of the frequency and abundance of the discharges, which often come away in large quantities. Mauriceau, Camper, and Capuron supposed that these waters proceed from the interior of the amnion; for, in certain cases, they say, the membranes may yield at a point quite distant from the neck, and the superabundance of this fluid will then gradually drain away, though still an abortion may not occur.

This explanation is not applicable to the greater number of cases of hydrorrhœa, for observation does not show that when water came away several times during pregnancy the amount lost during labor was less than usual: beside which, careful examinations of the membranes after delivery have very rarely detected traces of old rupture. Some well observed cases, however, prove that Mauriceau's opinion may be exceptionally true. (See page 543.)

It is much more probable that the fluid which thus escapes in the course of gestation, sometimes a few days only before term, had accumulated between the internal uterine surface and some portion of the membranes (variable in extent) that were detached. This is the view advocated by Nægèle, and it has been lately reproduced by one of his pupils in a thesis sustained at Heidelberg, from which I have derived most of these details. That is to say, the fluid secreted by the internal surface of the organ gradually detaches the membranes, thereby forming a pouch for itself until its constantly-increasing quantity succeeds in separating them as far as the neck, when an irruption of the liquid takes place.

This theory was confirmed by the autopsy of a pregnant woman affected with hydrorrhœa. Dr. Duclos, of Toulouse, who relates the case, found the membranes partly detached and from that point the fluid escaped. Elsewhere the membranes were raised by an accumulation of fluid between them and the uterine wall, being thus ready, so to speak, to give rise to a fresh attack of hydrorrhœa whenever the detachment should extend to the cervix.

Now, if we admit with Professor Burdach, that an exhalation takes place from the internal surface of the uterus, which, by transuding through the membranes, reaches the amniotic cavity, and thereby contributes to the nutrition of the fœtus during the greater part of the intra-uterine life, it would be easy to explain this abnormal accumulation of fluids, either by an excess of secretion or an arrest of transudation. It may also be explained by supposing that the secretion continues beyond the ordinary term, and the liquid is obliged to create a cavity or a kind of reservoir for itself by detaching the membranes to a certain extent.

Generally speaking, this is not a serious affection; nevertheless, if frequently repeated, it might bring on premature contractions.

The treatment is very simple. The patient must maintain the most perfect rest, avoiding all moral and physical excitement during the flow, and for seven or eight days after it has ceased. Should it be followed by slight contractions, enemata, containing laudanum, would arrest them; and if the discharge is accompanied by any evidences of general or local plethora, these symptoms must be promptly met by the appropriate measures.

[§ 3. Dropsy of the Villi of the Chorion. Hydatiform Mole.

The villi of the chorion sometimes become distended by fluid which collects within them, causing them to swell and assume the form of rounded vesicles, comparable to gooseberries or grapes, and having, consequently, some resemblance to hydatid vesicles. On account of this analogy, they were, for a long time, supposed to be true hydatids. M. Velpeau was the first to discover that the hydatiform mole has its origin in the chorion, and the microscopic examinations of Prof. Robin exhibited still more clearly the true nature of the disease by showing that the envelope of the hydatiform vesicles have all the anatomical characteristics of the walls of the villi of the chorion. It is now regarded as certain that the disease known as hydatiform mole is nothing but a dropsical condition of the villi of the chorion.

Though the affection is a rare one, we have a good account of it in Dr. Cayla's thesis, which we have found very useful in the preparation of this article.

If an ovum, presenting the alteration in question, be examined, the villi are seen, as usual, detached from the surface of the chorion. In some cases, the pedicles will have undergone no change in size, whilst at others they will be slightly dilated. The dilatations, or vesicles, begin to appear where the ramification commences, the branches of the villi being found swollen at intervals. The dilatations vary in size from that of a walnut to that of a filbert, and so down until they become almost invisible to the naked eye. A whole villus is often almost completely metamorphosed into a bunch of vesicles almost as large as gooseberries. Upon the larger of these, smaller ones are often inserted, and generally by a very fine pedicle, a portion of the undilated branch of the chorion. The pedicle varies from ·039 to ·078 inches in length. Sometimes it is extremely fine, but may reach a diameter of ·039 inches; in which case it allows the fluid to flow through it from

one vesicle into the other. More frequently, it is obliterated through a greater or less extent of its course. All the vesicles of the same group are, therefore, connected by pedicles, forming groups of the strangest appearance, but, nevertheless, recalling that of the villi in the normal condition.

It is generally easy enough to separate the vesicles from each other, and to trace the pedicles down to the chorion; sometimes, however, they are inextricable.

The fluid contained in the vesicles is usually colorless, transparent, liquid as water, and containing albumen in solution. Occasionally, the contents are of a reddish color.

This dropsical condition may affect either the villi of the chorion, properly so called, or those of the placenta, and in both cases the life of the fœtus is nearly always compromised. The dominant fact in the affection is, after all, the arrangement of the umbilical vessels. Should all the villi become dropsical, the death of the fœtus would necessarily ensue, and, occurring at a period very near that of conception, it might undergo solution in the amniotic fluid, and thus disappear.

Should the alteration of the villi be more recent or less complete, we should have an embryonic mole, in which the body of the fœtus would present various grades of development. Sometimes even, though rarely, when the alteration affects a small number of villi, the fœtus may be fully developed. Finally, a case of M. Brachet's proves that a few hydatiform vesicles occurring on the placenta do not prevent the birth, at term, of a healthy child of the usual size. It is certain that in twin pregnancies an alteration of one ovum may affect the other injuriously; still, some cases, reported in the Dictionary, in thirty volumes, show that one ovum may be transformed into a hydatiform mole, whilst the other fœtus undergoes regular development, and is born at term.

By what symptoms may dropsy of the villi of the chorion be suspected or discovered? If the alteration be slight, none of the usual signs of pregnancy will be wanting, and then a diagnosis will be almost impossible. If, on the contrary, the change is so great as to completely alter the ovum, the affection may be suspected and occasionally discovered. All writers admit that attacks of hemorrhage are common in such cases, and they almost always coincide with an unusual development of the uterus, whose size is no longer in conformity with the presumed period of gestation. These two symptoms are found conjoined in a case of M. Depaul's, already published by M. Cayla. The most important sign, however, is a too rapid increase in the size of the uterus, and by it was a positive diagnosis made in the following case, which we owe to the kindness of M. Pajot, from whom we received it. The account will be read with interest: "I saw a case of so-called uterine hydatids in connection with Dr. Gocherand (of Ivry), and although it was the third one of the kind which has fallen under my notice, the circumstances attending it were very different from my own two first cases, and afforded the opportunity of studying a much greater alteration of the villi of the chorion."

The patient was a young woman who had given birth to a child about a year previously, and who now supposed herself to be about three months pregnant. On making an examination I was astonished to find the uterus as large as at the eighth month of gestation. A very marked sense of fluctuation made me at first suppose that there might be a collection of fluid or a rapidly developed cyst of the ovary. However, I soon became satisfied that there was an accumulation of fluid in the cavity of the uterus itself.

By vaginal examination I found that the lower segment of the uterus was considerably developed. The neck was as soft as at the eighth month of gestation, and presented the indications of a previous labor. The finger could be inserted as far as to the internal orifice, which was closed hermetically. By passing the finger around the cul-de-sac, the left hand at the same time being applied upon the fundus of the uterus, the sense of fluctuation already perceived so clearly by palpation,

was again evident. There was no solidity at any point of the abdomen. The patient's general health was bad; she had a dry, hot skin, and pulse at 120.

It was the only one of the three cases in which a diagnosis could be established.

I advised the insertion of a gum-elastic catheter through the internal orifice, and the administration of ergot. The advice was followed the next day, and the patient expelled, together with a large quantity of fluid, a multitude of hydatiform vesicles, either in a detached state or in clusters of five or six together. The entire collection would have filled a man's hat. The vesicles were taken to Paul Dubois, who showed them to his class, and made them the subject of a lecture.

The evacuation was followed by no improvement in the general symptoms; the patient continued to lose strength, and died a few days after the operation. Unfortunately, an autopsy could not be obtained. (Pajot.)

Although the uterus, in these cases, is generally too large for the stage of the pregnancy, it is sometimes in the opposite condition. (Thesis of Dr. Louvet-Lamarre.)

The pregnancy usually terminates earlier than in normal cases, expulsion of the ovum generally taking place before the sixth month, and in the usual manner; all the symptoms which precede, attend, or follow it resembling precisely those of abortion, though the accompanying hemorrhage is commonly profuse.

The formation of an hydatiform mole rarely appears to have any effect upon the general health of the patient, or upon subsequent pregnancies. Madame Boivin, however, mentions some cases of women who were so unfortunate as to suffer repeatedly from the affection.

ARTICLE II.

LESIONS OF THE VILLI OF THE PLACENTA.

Although changes in the structure of the placenta are quite common, our knowledge of them is as yet so limited, that in a work like the present we shall be able to notice only the most important of them.

A clear statement of what may be said of the pathology of the placenta, makes it necessary to revert to some details respecting the chorion and its villi. The two latter are composed of the same substance, that is to say, of a membrane formed of polyhedral cells, which are easily distinguished up to the sixth week. At a later period their nucleolus disappears, the nucleus loses its transparency, and the cell itself becomes filled with granules. In this way the chorion soon assumes the appearance of a continuous membrane, which is more or less granular and sprinkled with nuclei.

In its beginning the chorion has the form of a regular hollow sphere, with smooth outlines; soon, however, its surface becomes covered with multitudinous prolongations, to which the term villi has been applied. Almost all these prolongations are traversed by a canal, which terminates in a cul-de-sac at the free extremity of the villus, but opens freely at the internal surface of the chorion. This internal surface is, therefore, covered with minute perforations, each communicating with the canal of its respective villus. When the allantoid is formed, it becomes applied against the internal surface of the chorion, and quickly sends vascular prolongations into most of the villi. Some of these villi then continue to grow, so as to form the placenta; the rest become atrophied in a way which has been well described by Robin (*Archives Générales de Médecine*, 1848, *et Gazette Médicale*, 1854), and which affords the key to some of the lesions of the placenta. Prof. Robin's investigations may be recapitulated as follows: —

1. During the formation of the villi the development of some of them is arrested, so that they contain no central canal, and consequently can have no participation

in the allantoid circulation. They appear as solid cylinders, having imbedded in their tissue an abundance of grayish granules.

2. Although most of the villi are provided each with a canal, some of them fail to receive a prolongation of the allantoid; these, consequently, remain tubular, and are distinguished by the abundance of fatty molecular granules, with which their parietes are sprinkled.

3. Although nearly all the villi become vascular at a certain stage in the development of the ovum, most of them have become atrophied by the time the placenta is distinct. In following up this process of atrophy, the allantoid vessels traversing the villus are first observed to disappear, and the canal is quickly obliterated, being filled with a tissue resembling the reticulated magma. The walls of the villus itself become charged with fat in the shape of fatty granules and real oil-drops, sometimes scattered and sometimes in collections of various forms.

4. The placental villi occasionally present the same indications of atrophy as are constant in the other villi in the chorion; in other words, the placental villi may undergo atrophy, cease to be vascular, and exhibit an abundant fatty deposit in their walls.

We shall soon explain the mode by which the normal atrophy of the villi of the chorion gives rise to important lesions when it happens to extend to those villi which go to form the placenta.

FIBROUS OBLITERATION OF THE PLACENTAL VILLI WITH OR WITHOUT FATTY DEGENERATION.

The lesion in question has been described as *induration of the placenta, encephaloid, scirrhous, cancerous, tuberculous,* and *fatty degeneration:* still oftener has it been mistaken for a fibrinous deposit, the remains of a placental apoplexy. (See *Placental Apoplexy.*)

The degeneration appears in the form of grayish or whitish masses, which are always less red and moist than the rest of the placenta, and of a tissue which is hard, compact, friable, and but slightly stringy. This appearance has caused them to be mistaken for concrete pus, masses of crude tubercle or scirrhous formations. When, however, they are examined under the microscope, it is soon seen that all the parts of the tissue thus altered are composed of obliterated villi of the chorion with their tissue charged with fatty granules. All the ramifications, however, are not thus supplied with fat, since in the parts apparently the most diseased and distinguished by their whitish color, the villi contain no trace of fat granules, or have them only at long intervals. In a word, the lesion which we are describing is characterized by obliteration of the placental villi, precisely similar to the atrophy which invades the villi of the chorion after the formation of the placenta, and which we have described above.

This alteration is more especially met with at the circumference of the placenta, the cotyledons in that situation being the ones chiefly affected. It may always be found in the cotyledons of the periphery, or, at least, in a small portion of some of them: in this case, however, the affected ramifications of the chorion are lost, as it were, in the midst of those which remain pervious, and in this degree the disease is of no interest to the clinical observer.

In certain placentas, however, there will be one or several portions of cotyledons, or even one or several entire cotyledons, which have undergone fibro-fatty degeneration; and sometimes even the greater part of the placenta is thus transformed into a morbid tissue which is impervious to blood.

A placenta examined by MM. Laboulbène and Hiffelsheim had six of its cotyledons entirely obliterated, beside which there were discovered eleven other small, yellowish masses, presenting the same external characters and structure as the diseased cotyledons. The altered cotyledons are sometimes scattered through the

placental mass, at other times they touch by their edges, but are always definitely separated by deep furrows. The change is generally more evident upon the uterine surface of the cotyledons than upon the side of the chorion, for there the tissue resumes gradually its softness, humidity, and reddish hue.

"If the placenta be emptied of blood," says M. Robin, from whom we borrow almost the whole of this article, "the diseased cotyledons will project more than the healthy ones; but if the placenta be injected, the former will be depressed in comparison with the latter. This result is due to the fact that the ramifications which remained vascular in the emptied placenta, subside in consequence of the discharge of their blood; but as the obliterated ones do not collapse, their bulk remains greater than that of the others. When, on the contrary, the healthy and vascular cotyledons are distended by injection, they form a larger mass than those whose subdivisions are obliterated, and appear in relief beside them."

The alterations just described are independent of hemorrhage or placental apoplexy. Whenever the two affections have been confounded, the observers were, doubtless, deceived by their coincidence. It is, indeed, by no means rare to find an apoplectic space in the centre of the diseased cotyledons, large enough to contain a pea, a bean, or only a millet-seed, and the fibro-fatty degeneration of the villi has often been mistaken for a bleached clot. This confusion is now impossible, thanks to the microscope, which discovers in the mass of diseased cotyledons not a collection of fibrin, but a network of atrophied villi of the chorion.

A single argument remains in favor of the view which attributes them to apoplexy, to wit, that the hemorrhage which takes place causes the obliteration of the cotyledons. To us it seems impossible thus to make the obliteration subordinate to the apoplexy, and M. Robin's researches tend to prove that the fibro-fatty alteration may become a cause of hemorrhage as regards the neighboring villi which continue pervious. Moreover, as a matter of fact, placental apoplexy is met with, without obliteration of the cotyledons, and it is very often impossible to discover a trace of apoplexy in cotyledons which are completely obliterated. The two lesions are, therefore, mostly independent of each other.

Obliteration of the placental cotyledons is without importance as regards the mother, but, as will be readily understood, may be highly injurious to the fœtus. It is, indeed, proved that an almost constant relation exists between the weight of the fœtus and that of the placenta. Now in the case before us, any obliteration of the villi cuts off by so much the active portion of the placenta; if but a few villi be obliterated, the child experiences no bad effect from it, but if several cotyledons be altered, its development will be imperfect, and should half of the organ be invaded, its life will incur the greatest danger. In a still more advanced stage, its death is almost certain.

All our knowledge of the fibro-fatty degeneration of the placenta is, so to speak, condensed into the anatomo-pathological statement just given, and we are obliged to confess, as does Dr. Millet, whose excellent work may be consulted with advantage, that there is nothing to give us light upon the etiology of this lesion, no sign which enables us to fix its symptomatology upon a certain foundation. Sometimes, however, there have been evidences of uterine congestion in cases in which the patients had complained of weight or pain in the loins. These symptoms then resemble those observed in cases of placental apoplexy, and, we would observe, are really so vague or even insignificant that it would seem to us almost impossible to diagnose the fibro-fatty degeneration in a case of first pregnancy. As, however, the affection is liable to recur and sometimes adheres tenaciously to the same woman in all her pregnancies, the accoucheur may take warning and let the least trouble occurring either to the mother or fœtus during gestation have its weight in his estimate of the situation. M. P. Dubois says, in reference to these matters, that, if a sense of dull pain and fulness is connected with a slight diminution of the motions of the fœtus, there is reason to fear that it is in serious danger.

It is possible, then, to suspect or even to foresee the fibro-fatty degeneration of the placenta; but how shall it be prevented? What course shall be pursued if the woman becomes pregnant again?

M. Dubois' advice to his pupils, under these circumstances, is thus briefly stated by Dr. Millet: Advise the patient to avoid all kinds of fatigue; insist upon her lying down, and prescribe a light diet for the purpose of moderating the circulation. At the same time practise a revulsive bleeding to the extent of from one to two ounces, followed the day after by a similar one. In connection with this apparently reducing treatment, M. Dubois, without fear of being taxed with inconsistency, adds the use of iron, inasmuch as it has appeared to him that women are predisposed to the affection by a certain degree of impoverishment of the blood. The iron would, at any rate, seem in several instances to have benefited the patients.

ARTICLE III.

EFFUSION OF BLOOD IN THE PLACENTA.

Utero-placental hemorrhage will be studied in all its connections when treating of abortion or the hemorrhages accompanying delivery (see *Abortion*, and *Dystocia*); we are, however, to speak in this place of certain effusions of blood in the substance of the placenta which present peculiarities deserving of special attention. These effusions differ considerably both in situation and form, the variety being due, for the most part, to the more or less advanced stage of the development of the placenta. Thus, if the blood occupy circumscribed cavities formed in the tissue of the organ, it takes the name of placental apoplexy given to it by M. Cruveilhier, and will be described in the next paragraph. Up to the third month, however, not only may the blood be effused into the placenta itself, but may even extend beyond its limits and spread over the entire external surface of the chorion. This last variety will be the first to engage our attention.

As utero-placental hemorrhage has been so well treated of by M. Jacquemier, we can do no better than borrow several passages of his description. Up to the third month, as stated, the blood effused into the placenta has a great tendency to spread itself over the surface of the chorion; in fact, it could hardly be otherwise, for at the outset the placental villi are not yet connected by the amorphous tissue which at a later period forms of them compact lobes, and the circumference of the placenta is not yet well defined, there being no distinct limit between the villi of the placenta and those of the chorion, which latter are destined soon to disappear. The entire surface of the chorion is, in fact, at this time covered with prolongations which separate to a certain extent its external surface from that of the decidua reflexa until both membranes are brought into contact through the atrophy of the villi. Should a rupture now occur of some of the utero-placental vessels either in process of development or but recently perfected, the blood therefrom would soon reach all the vascular tufts of the placenta and villi of the chorion by spreading itself in a layer between the ovular decidua and the chorion. The aborted ovum under these circumstances often has a fleshy appearance, its surface being more or less bluish or blackish, whilst its walls form an envelope of variable solidity and thickness. If it be entire, a careful examination will often detect on the external surface of the placenta minute ruptures opening into cavities and closed or not by coagulated blood. Frequently, also, there is no rupture, although the placenta may contain deep-seated, circumscribed cavities or extensive diffused infiltrations. If the layers of the decidua be stripped from the ovum, the entire surface of the chorion, the portion occupied by the placenta included, will be found covered by coagulated blood which is firmly held by the vascular ramifications of the placenta and the villi of the chorion imprisoned in its substance. Both chorion and amnion are intact, the amniotic fluid having a slightly red color by imbibition. If the embryo

be very young, it may sometimes be found to be entirely dissolved, the only trace left of its existence being a very small bit of the cord still attached to the placenta by a few fragments of a very soft tissue. At other times the amniotic fluid may merely seem to be a little thicker than usual, resembling in this respect a mucilage of gum. Should the structure of the embryo be firmer, it will be found in its normal condition, only more or less withered and macerated according to whether the date of its death be more or less remote. The blood covering the entire surface of the chorion sometimes forms a firm and hard coagulum, which, occasionally, in some parts has lost its color and resembles the buffy coat of blood from venesection; at other times it is soft and presents the appearance of a black, thick, and granular fluid.

The amount of blood effused varies greatly, and the layer formed by it may be only from ·068 to ·136 inches, or from ·78 to ·1·17 inches in thickness. In the latter case, the ends of the villi will have lost their relation with the reflected and inter-utero-placental deciduas, thus producing an unnatural widening of the interstice which, in the normal state, is very small. The layer of blood is not of equal thickness at all points; in some places it collects in larger quantity, and that most generally where the placenta would have been formed. Ova thus affected have, sometimes, another appearance; thus, if during their expulsion the decidua has been removed, as often happens, they look like a clot of blood, but dissection and washing soon discover in their tissue the vascular ramifications of the placenta and villi of the chorion, showing that the seat of the effusion is the same as in the preceding case, and that they are not merely ova wrapped in their deciduas and enclosed in a clot of blood.

At a rather later period of gestation, say the third or fourth month, the effusion spreads much less over the surface of the chorion and shows a tendency to be confined to the placenta; still, it will sometimes extend beyond the edges of the latter in the form of streaks, projecting in various directions to a greater or less distance. The limitation of the effusion is due to the approximation and somewhat firm adherence between the chorion and the decidua reflexa, due to the atrophy of the villi of the chorion, so that a space no longer exists between the two membranes except for a variable distance near the border of the placenta. Even should we suppose that these effusions exert a considerable force, it is not generally sufficient to rupture the membranous envelopes which restrain them. Still it is not so very rare for the decidua reflexa to give way and allow the blood to pass into the cavity of the decidua and even reach the internal surface of the uterus. As an exceptional occurrence it is sometimes found to have ruptured the chorion and amnion, as in the cases observed by M. Gendrin, who found blood effused between the chorion and amnion, and even in the cavity of the latter, where it enveloped the embryo completely. Within the periods of fœtal life above mentioned, there can be no doubt that the effused blood proceeds from a rupture of the utero-placental vessels, even though it be impossible to detect any lesion upon the external surface of the placenta. It is impossible to suppose that the blood comes from the umbilical vessels, for we have seen that in some cases the embryo is so slightly developed as soon to be dissolved, whilst in others the amount of blood effused generally far exceeds the entire bulk of the embryo. If the umbilical vessels are ever ruptured, they could only be so consecutively to rupture of the utero-placental vessels, in which case the fœtal and maternal blood would mingle together.

An occurrence of this kind happening to the extent just imagined, would, generally, be fatal to the fœtus, though the ovum would not be expelled until later. As the effused blood is not in contact with the walls of the uterus, it does not stimulate the organ immediately to contraction, and it very often happens that when abortion takes place, the blood is found to have already begun to lose its color, as also to present other changes indicating that the hemorrhage must have taken place some time previously. Should the effusion be moderate, it would not seem impossible for gestation to continue. (Jacquemier.)

PLACENTAL APOPLEXY.

Mr. Jacquemier's book again guides us in describing placental apoplexy. From the middle of intra-uterine life the placenta continues to be quite frequently the seat of effusions of blood, which effusions are peculiar from the fact that they no longer extend beyond its edges between the now firmly united chorion and decidua. Instead of being diffused and occupying the greater part or even the whole of the placenta, these effusions are more fully circumscribed and confined to the lobes in which the ruptured vessels are situated, although they always show a strong tendency to extend toward the fœtal surface of the placenta. They also present varieties which may be described under three principal heads.

In the first variety there is no cavity, properly so called, produced, but the blood infiltrates the tissues of one or more lobes of the placenta, apparently diminishing its density. In some places it accumulates sufficiently to form little vacuoles filled with a very dark-colored fluid which in some cases has the appearance of a very thin jelly. (Jacquemier.)

In the second variety the effused blood forms a very irregular cavity, having prolongations in various directions, and the parts adjacent are infiltrated and stained of a reddish hue for a very considerable distance. The foci are usually quite large and mostly communicate with the external surface of the placenta through a rupture of greater or less size, with detachment of the parts corresponding; they are irregular in form and more liable to be found near the edge of the placenta in proximity to the coronary vein, which is sometimes ruptured, and communicating with the cavity. When the effusion takes place near the centre of the placenta it easily reaches the external surface of the chorion; and should it be near the point where the principal branches of the cord traverse the latter, a little blood will sometimes be found to have penetrated to a greater or less extent the tissues which surround the umbilical arteries and vein at the root of the cord. This condition has already been described in several cases, of which one published by M. Gendrin is very interesting; the cord, for the distance of two or three inches from the cavity in the placenta was infiltrated with blood, and yet there was no evidence of rupture of either of the umbilical arteries or of the vein. These irregular cavities in the substance of the placenta may be numerous, or there may be but one; and in case there are several, they may have been formed at the same period or at different times.

The third variety is the most remarkable of all; the cavities are here well defined and regular in form, even when the effusion seems to have occurred but very recently. Usually there are several of them, and judging from the appearance of the blood which they contain, they are produced successively. It is not uncommon to find seven or eight of them in the same placenta, and sometimes there are twenty or more. Simpson mentions a four months' placenta in which they were so numerous as to give the impression, upon dividing it, of a collection of innumerable, small, rounded, and distinct clots, closely compacted together. (*Dictionnaire en 30 volumes.*) It is rare for the clots to be larger than a pigeon's egg; some are as small as millet or hemp seeds, whilst others are of intermediate size. They are also situated at various depths in the substance of the placenta, some extending to the internal surface, and others approaching the uterine surface, upon which some of them open by a small and irregular orifice. The surrounding tissue of the organ is in its normal condition, and the appearance of extravasation of blood extends for but a few lines beyond the boundaries of the cavities. These regularly formed clots begin to lose their color at the circumference, so that at a certain period the cavity exhibits a white, thin pellicle, which detaches more easily from the clot than from the placental tissue. (Jacquemier.)

We have hitherto said that the placental tissue surrounding the cavities is in a healthy condition; but this is not always the case. It will be remembered, indeed,

that it is not uncommon to find apoplectic collections in the centre of cotyledons affected with fibrous obliteration of the villi. (See page 551.) In such placentas occur very small, regularly formed cavities, enclosing clots of blood of an appearance compared by M. Jacquemier to black grape-seeds.

The blood effused in the tissue of the placenta, when the ovum is not expelled, separates into two portions, one solid, the other liquid. The serum disappears by infiltration, whilst the solid part forming a clot contracts, becomes denser and somewhat smaller, and gradually loses its color. The importance of the consecutive changes in the effused blood has, however, been greatly exaggerated; thus it was supposed that the transformation might be so complete as to produce whitish and homogeneous masses resembling concrete pus or tuberculous matter, but it is evident that in such cases effects have been attributed to placental apoplexy which were really caused by fibrous obliteration of the villi. (See page 550.)

We have said that when utero-placental hemorrhage occurs in the first half of pregnancy, it is occasioned by the rupture of some of the maternal vessels, generally the veins, and that it very rarely proceeds from the umbilical vessels. We think that the same observation applies to placental apoplexy.

The various kinds of apoplectic formations in the placenta may coincide with the lesion met with in uterine hemorrhages, whether internal or external; that is to say, with a partial or complete detachment of the placenta and the presence of a clot of greater or less size in the artificial cavity thus formed, together with streaks of coagulated blood stretching away to the cervix, and situated between the internal surface of the uterus and the uterine decidua. The ovum is then expelled prematurely, with the symptoms of an ordinary uterine hemorrhage. Effusions within the placenta, however, rarely occasion such extensive lesions, but are almost always limited and compatible with the continuance of gestation. The effect of placental apoplexy, moreover, varies with the period of gestation at which it occurs, as also with the number and extent of the effusions and the more or less frequent occurrence of the accidents. If the points of effusion are small and few in number, a considerable part of the placenta retains its natural structure and capacity for the fulfilment of its functions; in this case not only will the fœtus continue to live, but its nutrition will suffer little or not at all. Under opposite circumstances, if it should not die, it will be born feeble, puny, and emaciated. Should the apoplectic attacks recur at short intervals, they will often produce, in spite of all that can be done, gradual diminution of the motions of the child and of the pulsations of its heart, and the final cessation of both. In these unfortunate cases, it is not uncommon for both the mother and the accoucheur to be obliged to witness, as it were, the sufferings and death of the child. (*Dictionnaire en 30 volumes.*)

Apoplectic effusions in the placenta are rarely betrayed by any symptoms, provided the hemorrhage is limited in amount. In some cases, most of the indications of moderate internal hemorrhage are observed, though its occurrence will be rather a matter of suspicion than of certainty, unless the patient has suffered from the affection several times previously; for it is by no means rare for the same woman to miscarry several times consecutively, and always from the same cause; and if she should be delivered at term, a number of effusions, both old and recent, will be found in the placenta. (Jacquemier.)

Supposing there is reason to fear the occurrence of placental apoplexy, and especially if the woman is predisposed to the affection, the prophylactic treatment had recourse to in cases of uterine hemorrhage during pregnancy, will be indicated (see *Abortion*). As measures offering the greatest chance of success, we would mention absolute rest and small bleedings, to be repeated at longer or shorter intervals.

CHAPTER IV.

DISEASES AND DEATH OF THE FŒTUS.

§ 1. Diseases of the Fœtus.

Although the diseases of the embryo and fœtus during intra-uterine life are numerous, they are very little known. As it does not enter into the plan of this work to treat fully of subjects coming under this head, the history of monstrosities and whatever else belongs to teratology will be laid aside, and we will merely present succinctly such diseases as are most interesting to the accoucheur on account of their endangering or destroying the life of the child. As we even think it best to defer the account of such as might obstruct natural delivery, until we come to treat of dystocia, our task for the present will be quite a limited one.

1. *Inflammation.*—Traces of inflammation have been detected in various organs of the fœtus. As the most important we would mention peritonitis, which was made the subject of a special treatise by our colleague and friend Dr. Lorain. It was most frequently observed in lying-in hospitals during the prevalence of puerperal fever.

The pleura and lungs are sometimes attacked with inflammation, though less frequently. But although rare in the human species, it is very common in animals affected with epizoötic pneumonia,—a fact to which I called attention in my paper on puerperal fever.

2. *Fevers.*—It would seem that the eruptive fevers may be communicated by the mother to the child. There can be no doubt of the fact as regards variola, and we have nothing to add here to what has been said elsewhere (see pages 446 and 447) on the subject; and the same remark applies to intermittent fever. (See page 445.)

3. *Icterus.*—Several observers have reported cases of women having icterus giving birth to children affected with the same disease, the waters also being of a yellow color. These are, however, exceptional cases, as it is far more common for children born of jaundiced mothers to be free from any abnormal color. (See page 451.)

4. *Syphilis.*—We have already said that syphilis may be inherited. The fœtus thus affected usually undergoes a very regular development; and not until some weeks or months have elapsed after its birth, do the accidents appear which, therefore, it does not fall within our province to describe. This, however, is not always the case, for it is by no means rare for the syphilitic fœtus to be born prematurely or even to die before birth. These children, like the former, when examined immediately after delivery, generally exhibit no lesion which can be attributed to syphilis, though in some, traces of the disease are evident, the most common being pemphigus of the palms of the hands and soles of the feet. When the bullæ are perfect, the eruption is easily recognized, but they are almost always ruptured and their place occupied by rounded erosions with elevated epidermis. Still, they have a characteristic look. Pemphigus is more difficult to recognize when the eruption is beginning: it then appears in the form of small, red, and barely projecting spots, marked in the centre with a whitish point, due, doubtless, to a slight elevation of the epidermis. I have met with two cases of this kind, which are represented in wax models deposited in the hospital of the Clinique, and the reports of which were published by Dr. Bernardot (*Thèses de Strasbourg*).

Autopsies of the children sometimes reveal visceral lesions due to syphilis, such as certain alterations of the thymus gland, lungs, and liver. Prof. Dubois was the first to call attention to syphilitic alteration of the thymus gland. Externally the affected organ seems healthy, but if cut open and squeezed, a whitish fluid resembling pus exudes from it. When the lung is the seat of the lesions, these

consist of indurated nodules varying in number and size, and of about the consistence of the liver, as stated in a detailed account of the affection by Prof. Depaul. Some of these indurated masses project beneath the pleura, under which circumstances they present quite a deep-yellow hue. At a later period they undergo softening and have at their centre a cavity containing a fluid of a sero-purulent appearance. The lesions of the liver have been well studied by M. Gubler, who describes them as being sometimes general, sometimes partial, and characterized by spaces of indurated yellowish hepatic tissue, whose normal structure is infiltrated with fibro-plastic elements and an albuminous fluid resembling the serum of the blood. The indurations are distinguished from the healthy tissue of the organ by their contour, hardness, and resistance to the finest injections.

5. *Dropsies.*—Hydrocephalus, hydrorachis, ascites, and cysts are affections to which the fœtus is quite liable; but as they often cause difficulty during labor, they will be treated of under the head of dystocia. (See *Dystocia.*)

6. *Spontaneous Fractures.*—Cases have been reported of spontaneous fractures, almost always multiple upon the same fœtus. Chaussier mentions a child born at the Maternity Hospital, in 1803, after a rapid and easy labor, during which no force had been applied to it, which had forty-three fractures, involving the cranium as well as other bones. Some of the fractures were recent, in some callus was forming, and others were thoroughly consolidated. Another case, cited by the same observer, is still more extraordinary. The child in question, which was born after an extremely short and easy labor, in a state of debility and of a bluish color, expired in a short time. Attention was attracted to it by its extreme shortness and an unusual mobility in the continuity of its bones. One hundred and thirteen fractures were counted by Chaussier, involving the different bones of the cranium, chest, and limbs (Jacquemier). The causes of this singular lesion are unknown; it is most probably due rather to arrested development of the bony tissue than to fracture properly so called.

7. *Complete or Incomplete Amputation of the Limbs.*—Cases not less curious than the preceding are those in which the children are born with limbs amputated at various heights, and having a cicatrix at the centre of the stump. Chaussier saw three deprived of the hand and a portion of the forearm. In one of these cases, a small bony cylinder found on the fœtal surface of the placenta was recognized as a portion of the radius. The stump, undergoing cicatrization, was covered at its centre with granulations. Watkinson, in 1824, attended a woman in her first labor who had experienced nothing unusual during her pregnancy. The child was born prematurely, and lived but twenty minutes. Its left leg appeared to have been amputated just above the malleoli. The foot, smaller than the other, was found in the vagina, but presented no appearance of gangrene or alteration of color or consistency. The two divided surfaces (of the foot and of the limb) were almost entirely cicatrized, and both presented small projections formed by the ends of the bones. Montgomery, in a work on this subject, relates two cases very similar to the preceding, in which the detached feet were expelled before the child. Cicatrization was complete in one, and far advanced in the other. (Jacquemier.) It would be easy, though I think useless, to mention other examples of this species of deformity.

Spontaneous amputation is sometimes incomplete; that is to say, grooves of greater or less depth, occasionally extending to the bones, are observed upon the limbs.

What is the cause of this singular lesion? Some have supposed it due to circular turns of the cord around the limbs, acting as does a ligature around the pedicle of a tumor; but it is very difficult to suppose that the cord could be drawn tight enough to amputate a limb without arresting the placental circulation at the same time. Montgomery's explanation is much more probable; he supposes the amputation to

be effected by constricting materials other than the cord. In several cases were found fibrous bands, whose origin it is difficult to determine, which constricted the limbs as would real cords, and which would have occasioned complete or incomplete amputation according to the degree of constriction. It must, however, be said that these bands are not always to be found, so that the etiology of spontaneous amputation is very uncertain. It cannot be affirmed, says M. Jacquemier, that they are always the mechanical effect of a constricting agent; they may possibly be due to a deep-seated local lesion and to the constriction induced in the skin by an extensive cicatricial action.

§ 2. Death of the Fœtus.

The causes which destroy the life of the embryo and fœtus are numerous, but we shall not attempt to recapitulate them here, referring the reader to the chapters which treat respectively of the diseases of the mother and of the ovum and fœtus, as also to the article on abortion. It must, however, be confessed that it is often impossible to determine the cause of death or to discover anything which can explain it in a satisfactory manner. Some of these unknown causes have attracted attention by the persistence with which they continue to act in the same woman through several successive pregnancies. I myself knew a woman in good health, who, on thirteen consecutive occasions, and without any discoverable reason, lost her child during the last month of gestation. Since Denman's time, it has been supposed that in these cases recourse might be had successfully to the induction of premature labor. We would also revert to the fact (see page 271) that in twin pregnancies one fœtus sometimes dies and assumes a mummy-like condition, whilst the other undergoes its regular development. This occurrence can only be known after delivery.

It is not always easy to assure ourselves that the fœtus is dead; it will sometimes be suspected when it ceases to move, especially after having been unusually active. At other times, the spontaneous motions gradually grow less frequent and weaker, and finally cease. Too much importance ought not, however, to be attributed to this sign, because the fœtal motions present numerous anomalies, even in the midst of the most perfect health. The surest indications are derived from auscultation of the fœtal heart. "In regarding the subject from this point of view," says M. Depaul, "we must set aside the three first months of gestation, during which the sounds of the heart cannot be heard, and also remember that in many cases it is impossible to perceive them before the expiration of the fourth month. During the last half of gestation, the conditions are altogether different, success in the stethoscopic examination being the rule, whilst failure should be regarded as a very rare exception. Inasmuch, however, as this exception may exist, it is impossible to attribute an absolute value to auscultation of the fœtal heart as a means of determining whether the child be living or dead. It would be a great mistake, however, not to regard it as an extremely valuable means, since, in the immense majority of cases, it leads to probabilities which amount almost to certainty, and consequently allows questions of the highest practical interest to be solved." (Depaul, *Traite d'Auscultation.*) Out of 67 women, more than five months pregnant, in whom M. Depaul was unable to hear the pulsations of the heart, but three were delivered of living children.]

Further, the phenomena experienced by the mother after the death of the fœtus are very singular in these cases: the abdomen collapses instead of increasing in size; the breasts, which had become developed, shrink; the woman suffers from a sensation of weight in the loins, and an unusual pressure in the lower part of the abdomen; an inert body in the uterus obeys the laws of gravity and falls to whichever side the woman turns in bed.

Other symptoms are soon added to the foregoing. If the gestation is somewhat advanced, everything passes off absolutely as if the expulsion of the embryo had occurred, only excepting the discharge of the lochia: thus, in the course of forty-eight to sixty hours after its death, the breasts swell up, the phenomena of milk fever are manifested, and the lacteal secretion is fully established, after which the breasts again subside, and the usual order is resumed. As a general rule, the prolonged retention of a dead infant does not produce any disastrous result to the mother, and I suspect that writers have greatly exaggerated on this point: they say, indeed, that the woman becomes depressed, uneasy, and of a fretful temper; that she experiences lassitude, alternations of heat and cold, oppression at the epigastrium, headache, syncope, palpitations of the heart; her face is pale, the eyes dull and surrounded by a livid circle, the breath fetid, pulse frequent and irregular: in a word, all these general phenomena of a slow fever have been considered by them as so many rational signs of the child's death. But these symptoms are certainly absent in the majority of cases; for most women, after we have succeeded in calming their fears, experience nothing of the kind, and I have known many of them to carry a dead child for several months without even suspecting it, and some even to congratulate themselves upon the amelioration of their general condition, in consequence of the sudden disappearance of the sympathetic disorders of pregnancy. At an indeterminate period labor comes on, and the abortion is effected.

By examining the dead fœtus, we may learn why its prolonged sojourn in the uterine cavity has been wholly innoxious to the mother. In fact, the infant is not putrefied, as is proved by its having no bad odor; the solid parts undergo a peculiar transformation, and the body is somewhat analogous in appearance to one that has been soaked for a long time in water.

When the fœtus remains in the uterus thoroughly protected from the air, it does not putrefy, but undergoes maceration. M. Martin (of Lyons) judiciously remarks: "The kind of alteration which a dead child undergoes in the womb, will also vary according to the period of pregnancy at which it ceased to live. Thus, in the early stage of its formation, when its organization has but little consistence, and approaches the mucilaginous state, it dissolves in the waters of the amnios, which then become thicker and assume the characters of a gummy solution, and no further trace of the embryo is found in the amniotic cavity. But at a period somewhat later, that is, from the second to the fifth month, it withers away, becomes shrivelled and dried up, and looks like a little mummy of a yellow color, or like a fœtus preserved for a long time in alcohol. Not unfrequently, the placenta likewise participates in this state of desiccation, the liquor amnii disappearing and being replaced by a thick and apparently an earthy humor, which incrusts the fœtus." (*Mémoires de Méd. et de Chir. Prat.*, page 96.)

After the fifth month, a child putrefied in the womb presents so different an aspect from one that has undergone the same process in the open air, that it is only necessary to observe this particular condition once or twice, never to mistake it afterwards.

Imagine the little defunct stretched on a table: the flaccidity of its soft

parts is then so very striking, that the head becomes flattened under the influence of its own weight, whatever position may be given to it; the soft parts on the thorax exhibit the form of the ribs; the front of the chest is very much flattened, the abdomen sunken and nearly hollow about the navel, and forming two large rounded projections on the flanks; even the extremities exhibit the same state of collapse. The discoloration of the skin is particularly remarkable, although often confined to the abdomen, at least when the sojourn of the fœtus in the womb has not been very long. The skin of this part has a brownish-red shade, without the least appearance of a greenish hue. This tint is less marked on the chest, neck, head, and limbs; nevertheless, it exists there also. But this is not the brownish hue that often succeeds a green putrefaction; it is a much clearer reddish-brown. The cord is no longer twisted, but it forms a true fleshy cylinder, of a reddish color, soft, and saturated with a brown fluid. The epidermis is detached from a considerable part of the surface, and may be easily separated from those places where it is still adherent, thus leaving the humid dermis exposed, which is as glutinous as if it were lubricated by a mucous fluid; and then the true skin has a bright rose color. The epidermis on the feet and hands is white and thick, and looks as if it had been corrugated by cataplasms. The subcutaneous cellular tissue is infiltrated with a reddish serosity, which is also seen between the muscles, and sometimes in the substance of the muscular tissue itself. The bones of the head are feebly held together, their periosteum may be readily detached, and they are movable on each other. The cellular tissue underneath the hairy scalp is infiltrated with a thick serosity, resembling currant-jelly in appearance. Finally, whenever we attempt to move or raise the fœtus, it slips through the hands just like a fish that lives for some time out of water, in consequence of the fluid mucus covering its surface. (Devergie, *Méd Legale.*)

A dead fœtus is merely a foreign body in the uterus, which will soon have to be discharged. The time at which the expulsion will take place varies greatly; sometimes after a few days only, sometimes weeks will elapse, and occasionally a month or more. The symptoms which arise will be those of abortion or labor, according to the age of the fœtus at the time of its death. (See *Abortion.*)

CHAPTER V.

OF ABORTION.

THE term *abortion* has been applied to the expulsion of the fœtus from the womb, where this occurs at a period of pregnancy when the product of conception is not yet viable: that is to say, an abortion may take place at any time between the commencement of pregnancy and the end of the sixth month. The ancients applied the term *effluxio* to this accident, if it happened before the seventh day.[1] The term *premature labor* is usually applied to expulsion occurring after the sixth or seventh month.

[1] We place the period of viability at the *seventh* month, though well aware that some cases have been reported where fœtuses born at six, or five, or even four months, have lived; but such instances, besides not having all the authenticity desirable, are too rare to invalidate the general law.

In a recent and very remarkable article by M. Guillemot, this author admits three varieties of abortion, founded on the period of its occurrence: thus, *ovular* abortion is the title he gives when it takes place before the twentieth day; *embryonic*, if prior to the third month; and *fœtal*, from the latter date up to the sixth month of gestation.

Persons out of the profession, further, designate abortion under the title of miscarriage (*fausse couche*).

Abortions are much more frequent in the first two or three months than at any other period. The great vascularity of the uterine mucous membrane, become the decidua, and the ease with which effusions of blood may take place into the space which originally exists between the chorion and the reflected portion of the decidua (see page 552), sufficiently explain the frequency of hemorrhage, and consequently of abortion in the early months. In making this remark, I am not ignorant that Madame Lachapelle has given a different view, but it was because her position at the Maternity rarely furnished her with opportunities of observing abortions prior to the fourth or fifth month, for females do not usually go to the hospitals on account of the miscarriages of the first five or six weeks of gestation; and though other persons have since adopted her opinion, it is doubtless owing to the difficulty of diagnosis, and to the errors of females themselves, who, supposing they have only a simple retardation of the menses, allow an abortion to pass away in the early stages unperceived.

Morgagni and Desormeaux supposed that abortion of fœtuses belonging to the female sex are more numerous than of males, and I do not know whether the vulgar opinion opposed to this is true or false; but certain it is, that at term the boys exceed the girls in the proportion of sixteen to fifteen, which would seem to prove that female abortions are the most numerous; and besides, it is possible that the difficulty of distinguishing the sex in the earlier periods of intra-uterine life may have had some influence in creating the popular error.

The history of abortion evidently includes the study of the causes producing it, the symptoms and consequences which may arise, the signs by which it may be detected, and the more suitable indications for preventing or opposing it.

ARTICLE I.

CAUSES.

Considered in relation to its determining causes, abortion may be divided into the *spontaneous* and *accidental*.

The term *provoked* has also been used, where the abortion has resulted either from criminal efforts, or from the measures adopted by the scientific physician with a laudable object. We shall retain this division for etiological purposes.

§ 1. Causes of Spontaneous Abortion.

[The causes of spontaneous abortion may be sought for either: 1. In the father. 2. In the general health and habits of the mother. 3. In the state of the womb and its appendages. 4. In diseases of the ovum. 5. In diseases of the fœtus.

1. *Causes due to the father.*—At first thought, says M. Ferdut, considering the transitory part taken by the father, it would not seem probable that he could be the cause of a miscarriage which should not take place until after two or three months. Such, however, is the fact, as is proven by the experience of women who invariably miscarried during the life of a first husband, but who were several times delivered safely at term after a second marriage.

The influence of the father in causing abortion may be exerted in two ways—by his constitution and by his diseases. Ova, fecundated by men who are either too old or too young, rarely become, it is said, fully developed, and the same remark applies to those whose constitution is exhausted by debauchery or excesses of any kind. From M. Devillier's article in the new *Dictionary*, it would seem, however, that he thinks the idea of an influence exerted by the father in the causation of abortion should be received with considerable reserve. We would remark, says this author, that the procreative power is entirely distinct from that of development. If a man, under the conditions mentioned, has been able to fecundate a robust and healthy woman, the generative influence once having been communicated by him, the development of the product of conception would thenceforth be almost wholly under the influence of the vitality of the woman; so that it is probable that the influence of the father would at least be very limited. (Devilliers.) It will also be understood that diseases of the father may, to a certain extent, be transmitted to the fœtus and produce abortion. Of all these morbid conditions, syphilis exerts a more deleterious influence upon the duration of pregnancy than any other, though, it should be stated, all authors do not agree upon the subject. We believe, at any rate, that we would be correct in saying that, in some cases, the father, and not the mother, ought to be subjected to a prophylactic treatment.]

2. *General Condition of the Mother.*—Women of a plethoric habit, and having copious menstrual discharges, are greatly exposed to abortion during the early months of gestation; in fact, we have already alluded to those hemorrhagic molimens that appear in them at every monthly period. Again, nervous, or very irritable women, those who are strongly affected by moral impressions, such as anger, chagrin, &c.; females of a sedentary habit, who are always shut up in the shops, as well as those that follow an indolent life, passing their time at balls or soirées, and in light reading, also abort very frequently. The surrounding atmospheric conditions are not wholly without influence in the production of abortion; in fact, we may refer to this cause those epidemic miscarriages spoken of by most authors. Mountainous countries, where the air is bleak, are considered as being favorable to their production; for, according to the report of Saucerotte, the women inhabiting the summit of the Vosges are very subject to abortion, and they are in the constant habit of descending into the adjacent plains to avoid this accident.

Acute diseases, especially the eruptive fevers, and small-pox most particularly, occurring in the course of pregnancy, abdominal or thoracic affections, and recent cutaneous diseases, often give rise to miscarriage. Syphilis in the mother has the most disastrous influence upon the progress of gestation, and even the mercurial treatment does not always secure from abortion. Some writers think that the administration of mercury endangers the life of the fœtus. Their opinion is, however, rejected by most modern writers upon syphilis, almost all of whom regard the antivenereal treatment begun at the outset of pregnancy, as the best means of preventing

abortion. The numerous facts which have come under our own observation, have changed our opinion upon this point, and we now think it most prudent to begin the treatment as soon as possible.

It often happens, indeed, that, notwithstanding the existence of constitutional syphilis, when the mother has been treated properly and sufficiently long, the pregnancy continues to the full period, and the child escapes the infection to which it seemed fated. (Duval.)

According to the author just quoted, it would seem that much depends upon the length of time which the disease has lasted. "Numerous observations," he says, "show that syphilis at its commencement does not usually endanger the product of conception, but that, at a more advanced period, it involves the greatest peril." It should also be remembered that Dr. Paul's researches have shown that lead-poisoning may likewise produce abortion.

The convulsive diseases may occasion miscarriage either by provoking uterine contractions, or by directly destroying the child. (See *Eclampsia.*)

3. *Diseases of the Womb and its Appendages.*—The causes dependent on the uterus are referable either to a particular state of that organ, or to a peculiar habit of the body, the influence of which is reflected back on the womb. The following are given as causes of abortion dependent on this source: An excessive rigidity of the uterine fibres, and their consequent resistance to dilatation; an unusual contractility and sensibility of the organ, and too great a laxity and weakness in the uterine neck. I willingly admit that, in certain females, the excessive sensibility of the uterine fibre will scarcely support, without reaction, the strange modifications it must undergo during gestation; but I do not equally comprehend that species of opposition, which some authors seem desirous of establishing, between the resistance on the part of the uterine walls and the expansive force of the ovum. What, indeed, can an ovule, a few lines in diameter, effect against the thick walls of the womb? or, what action can it possibly have on the uterine neck, that will explain the influence which has been accorded to this pretended laxity of the cervix, on the frequency of abortions? The truth is, the ovum and the uterus are developed simultaneously, but by forces peculiar to each. Therefore, although abortions are more frequent in primiparæ, where the females have been married too young or too old; and although certain women abort in all their pregnancies at nearly the same period, we must not on that account attribute these accidents to too great a resistance of the body, or to an extreme laxity of the neck; for these repeated miscarriages, when not owing to the hemorrhagic tendency before alluded to, are far more naturally explained by the excessive irritability of the womb. The organ has to habituate itself, as it were, to its new functions; a proof of which is, that, in many females, the accident is repeated a number of times, but each time at a more advanced period; so that, about the fourth or fifth pregnancy, they go on till full term. Hence, those uterine congestions, which are so often produced in plethoric women by the menstrual periodicity, and that excess of sensibility as well as of irritability observed in nervous females, are the only two predisposing causes that I consider as belonging to the uterus proper, and even they are mere exagger-

ations, as will be seen, of the physiological condition. Where abortions are often produced by the influence of either of these, they are designated as *periodical.*

But, independently of these two causes, we must evidently take into account all the diseases of the uterus, whether acute or chronic, whose action is discernible: thus, the various tumors which may grow in the substance of its walls, or may contract adhesions with them and the foreign bodies developed in its cavity, also ulcerations, whether syphilitic or otherwise, which are so frequently found upon the cervix, are so many predisposing causes, which may both hinder and oppose its free enlargement; and lastly, let us add the various displacements of the uterus, such as prolapsus, lateral obliquities, or anteversion and retroversion, as acting in the same manner.

On the part of the appendages, all the chronic diseases to which they are subject; the adhesions, deformities, displacements, and their divers degenerations; the organic alterations of the tubes, fibrous, polypous, or other productions seated in the uterine tissue or neighboring parts; unnatural adhesions of the broad or the round ligaments, tubes, or ovaries: in a word, everything that can impede the easy and free development of the womb, must be regarded as occasional causes of abortion. (Madame Boivin, *Recherches sur une cause peu connue d'avortement.*)

Finally, an inflammation of the adjacent organs, particularly the bladder, rectum, &c., may, through the irritation thereby communicated to the uterus, bring on its contractions. Moreover, the existence of any voluminous tumor in the abdomen must necessarily incommode the development of this organ; also the compression of the hypogastrium, that some women produce by the use of corsets, may have the same effect.

According to Peu, we must add to these various sources of inconvenience, contraction of the pelvis opposing the distention of the womb, and sometimes its elevation above the superior strait; more especially when the narrowness of the latter coincides with the regular, or even an increased size of the excavation.

4. *Diseases of the Ovum.*—Any of the diseases of the ovum may give rise to abortion, and we shall not repeat what we have said concerning them. (See *Diseases of the Ovum*). It will suffice to mention here that the most important of these diseases are, dropsy of the amnion, hydrorrhœa, the hydatiform mole, placental apoplexy, and fibro-fatty degeneration of the placenta.

As regards the insertion of the placenta over the neck, I can scarcely believe that it could produce an abortion, and hence I imagine that the cases cited in support of that view have been misinterpreted; the insertion has been considered as the cause of the accident in those instances, when it certainly was nothing more than a simple coincidence. M. D'Outrepont has advanced the torsion of the umbilical cord as a cause of determining the death of the fœtus; for the state of compression, says he, resulting therefrom, may impede the circulation. The embryos had been dead for a long time, in all the cases of that kind observed by him.

Again, it may be asked, if the umbilical cord is too short, could it drag off or detach the placenta, or even be ruptured itself? Now, to the facts bearing on this point, reported by Mauriceau, Stein, &c., M. Guillemot adds

the following: The fœtus was about three months old, the umbilical cord was tightly stretched and even half separated near its origin at the navel, two folds of it encirlced the neck, and some deep marks were left on this part from their pressure. The circulation, he continues, was therefore interrupted in the cord by the tension and compression it sustained; and the strangling of the child's neck also contributed to its death. M. Deneux has furnished a case of a rupture of the umbilical vein, and effusion of its blood into the tissue of the cord itself; he found there a clot, equalling a small nut in volume, which had interrupted the circulation in the umbilical vessels by its pressure.

Lastly, the disease of the membranes, and of the umbilical vesicle, also prove a frequent cause of abortion, especially in the early stages of embryonic life; for in more than two hundred products of conception, that had not passed beyond the third month, M. Velpeau generally found an alteration of some part of the ovum.

5. *Diseases and Death of the Fœtus.* — Circumstances, which are often unknown to us, may arrest the development of the fœtus: for instance, it may be affected in the mother's body, by those acute diseases which at times beset it after birth; and such affectiôns, though not always fatal to the new-born infant, are the most disastrous to the intra-uterine fœtus as they occur the nearer to the period of fecundation. (See *Diseases of the Fœtus.*) We may add, the presence of several children as a cause dependent on the child; in fact, we have elsewhere seen that the excessive distention produced by a twin pregnancy, frequently brings on premature contractions. However, the uterus is rarely developed enough prior to the sixth month to provoke such an accident, for this seldom happens until a more advanced stage, and then it no longer appertains to abortion properly so called.

Some diseases of the parents may affect the child; for example, a vitiated spermatic fluid communicates to the new being a principle which does not fail sooner or later to destroy it. M. Guillemot attributed the numerous miscarriages of a young lady who consulted him to this cause; for her husband, although of a suitable age, exhibited all the characters of premature decrepitude. Having become a widow, she remarried, was several times pregnant, and was always delivered happily at full term.

The mother, also, may transmit her diseases to the child. Nothing, indeed, is more common than to find children presenting, a few weeks after birth, evident traces of the venereal infection received from the mother during intra-uterine life, and hence we may conceive that this hereditary taint may prove fatal to the fœtus whilst still within the womb.

Small-pox is also sometimes communicated from the mother to the fœtus, and causes its death. It is remarkable that several circumstances seem to prove, that the infection frequently does not take place until after the mother's recovery. (See page 447.)

In some cases, the body of the mother is but the conductor of a contagious principle of small-pox. We might here add examples in addition to those already cited (page 447).

Some years ago, a woman, in the wards of Professor Fouquier, was delivered of a dead child affected with small-pox, although she had herself been

vaccinated. Finally, the illustrious Mauriceau relates that his mother when in the last stage of her pregnancy, had the misfortune to lose the eldest of her three sons by small-pox, to whom, notwithstanding her condition, she was unceasing in her attentions; and that at his birth, which occurred the day after the death of his eldest brother, he presented four or five pustules of small-pox.

In short, all the diseases to which the fœtus is subject may be followed by abortion. Its death always produces it.

§ 2. Causes of Accidental Abortion.

Besides the causes just enumerated, that have been designated by most writers as the *predisposing* ones, but which, perhaps, would be more appropriately called *slow-acting causes*, there are yet some others that might be termed *accidental* causes: such as those which operate from without, and make their influence more promptly felt. The latter are very numerous; indeed, on reading the published cases, we find that authors have considered all the moral and physical excitements that women are subject to, as so many causes of abortion. In most of the recorded instances, we can readily satisfy ourselves that the observers have attached too much importance to these occasional causes of its production; for, generally speaking, it would have occurred without them, only, perhaps, a little later; and even here the expulsion of the fœtus is, in truth, owing to the slow and gradual action of the predisposing cause. However, there are some accidental causes whose influence is indisputable. For instance, falls, excessive fatigue, too frequent coition, and severe contusions, have, in some instances, produced immediately a loss of blood, followed by abortion.

Falls and contusions may act in two ways: either by bruising or violently irritating the mother's organs, or by wounding the fœtus, and determining its death. The latter has been denied by some persons; but to the instances now known to science, I will add the following from my own observation: A young woman, six months pregnant, struck her abdomen violently against a table while walking in the dark in her chamber; during the night, the motions of the child were for a time quite tumultuous, then they diminished, and on the following morning could not be perceived at all. Two days afterwards she was delivered of a dead child, which presented an ecchymosis on its back as large as the palm of my hand.

Burdach speaks of a woman who received a blow upon the lower part of the abdomen, when in the sixth month of her pregnancy, and who was delivered of a child, the bones of one of whose legs and of a forearm had been fractured, and united at an acute angle. The jarring attendant upon travelling by rail, or too great use of a sewing-machine, are also capable of giving rise to abortion.

I shall not enumerate here the various circumstances that have been considered as occasional causes; but, by way of showing how their importance has been overrated, I will merely remark that, although certain women, who are constitutionally predisposed to miscarriages, may abort in consequence of a trifling fright, or the odor of a badly snuffed candle, yet there are others, on the contrary, who will suffer the most acute moral im-

pressions, and the most violent physical shocks, without any accident whatever resulting therefrom; and nothing would be more easy than to bring forward numbers of cases in support of this proposition; the following, however, may be sufficient: I had an opportunity of observing, at the Hôtel Dieu, when acting as an "interne" in the obstetrical wards, a young girl in the fifth month of pregnancy, who, being rendered desperate by the desertion of her lover, cast herself into the Seine, from the Pont Neuf, yet, notwithstanding so violent a shock, the gestation pursued its regular course. Again, M. Gendrin speaks of a young lady who was thrown from a chaise over the horse's head by the animal falling in his career. This lady was then five months pregnant, but the accident did not prevent her from reaching her full term. I met with a case precisely similar in the wife of a notary living near Paris.

I was consulted, in Sept., 1845, by a young lady, who was evidently six or seven months advanced. Her physician had suspected an inflammatory engorgement of the womb, and during the third or the fourth month this gentleman had applied fifteen leeches on the neck of the uterus itself; and, strange to say, not only was this application unattended by any accident, but the patient seemed relieved of the distress and pain in the hypogastrium. And, lastly, is it necessary to refer here to all the manipulations, and all the violent remedies, that some distracted women make use of in vain to procure an abortion?

§ 3. Causes on Account of which Abortion is artificially produced.

The third order of cases still remaining for our examination are the means of producing abortion. These must be distinguished according to the proposed object: that is, whether, in producing an abortion, the indication be to relieve the woman as well as the infant, if the latter is well developed, from the dangers that threaten them (and we shall treat of the means to be employed in such cases when we speak of the indications presented by the mother's vices of conformation), or whether, contrary to all the laws of morality, the design is to destroy the fœtus in the body of its mother, for the sole purpose of concealing the traces of an illegitimate pregnancy. But we have nothing whatever to say concerning the measures resorted to by criminal hands in such cases, for, unfortunately, they are too well known.

ARTICLE II.

SYMPTOMS OF ABORTION.

The signs of abortion vary with the period of its occurrence, and also with its determining cause. Thus, when it happens in the early days of gestation, it is attended by but very few remarkable phenomena; and, in general, the pain is so trifling that the patient scarcely suffers more than from a difficult menstruation. The first uterine contractions are sufficient to produce the complete separation of the ovum, the adhesions of which are still very feeble; and it escapes either in mass or in shreds, usually surrounded by fluid or half-coagulated blood, and, being mistaken for a clot, it often passes away unnoticed, most women then supposing that they have

only had a slight postponement of their menses, followed by a more difficult and abundant flow than usual.

At a more advanced stage, the symptoms are much better marked, but still vary with the cause of the abortion. For instance, when this accident has been produced under the influence of bad health in the mother, or of chronic diseases, or those causes that operate slowly, by altering the genital organs, or the ovum and its membranes, the following symptoms are ordinarily observed, namely: shiverings succeeded by heat, anorexia, nausea, thirst, spontaneous lassitude, palpitations, cold extremities, pallor, sadness, depression of spirits, tumefaction and lividity of the eyelids, want of brilliancy in the eyes, a sense of sinking at the epigastrium, of cold about the pubis, of weight near the anus and vulva, pain in the loins, vesical tenesmus, frequent ineffectual desires to urinate, and a weakness and flaccidity of the breasts, from which a serous fluid sometimes exudes. These phenomena may be considered as the precursors of an abortion; for, when they have lasted for some time, the pains in the loins become more and more acute, extend round to the hypogastrium, and are renewed at short intervals, finally assuming all the characteristics of the regular uterine contractions. During these pains, if the uterus is sufficiently high up to be easily distinguished above the pubis, it will be felt to harden sensibly, whilst at the same time a sanious discharge takes place from the vagina, afterwards becoming sanguinolent, and eventually replaced by liquid or grumous blood. If the woman be then examined per vaginam, the neck will be found partly dilated, the dilatation advancing progressively with the frequency of the pains; the membranes begin to protrude, then engage, and ultimately rupture; the waters escape, and the fœtus and placenta are successively expelled. Usually in those cases in which the cause has operated slowly, whether dependent on diseases of the mother or affections of the ovum, the fœtus dies before the labor, or at least during the first pains.

When the abortion is a consequence of the occasional violent causes, it usually has quite another course. Thus, in some instances, the expulsion of the ovum closely follows the accident; a woman slips in descending a staircase, and falls violently on her seat; when she rises, her clothes are flooded with blood, for an ovum of six weeks has been driven out, together with a large quantity of fluid blood. This, however, is more apt to occur in the beginning of pregnancy; for, at a more advanced period, some interval always elapses between the accident and the consequent abortion. The phenomena then observed vary, according to whether the cause has affected the mother's organs, or has directly influenced the fœtus itself.

In the former case, the mother experiences, at the time of the accident, a sharp pain, either about the loins, or else in some part of the abdomen; after the lapse of a few days, during which the pain has diminished, or even entirely ceased, it is violently renewed, and followed almost immediately by uterine pains and contractions, a slight dilatation of the neck, some discharges of serosity from the vagina, at first reddish, then sanguinolent, and lastly pure blood.

Finally, if the travail continue, the fœtus is expelled as usual, and often living.

The expulsion is almost always effected very slowly, and the progress of the labor is far from being as regular as at term. The resistance occasioned by the length and hardness of the cervix at this period sufficiently explain the extreme slowness of its dilatation; and even when the latter is sufficient, the contractile powers of the uterus are yet so feeble that the ovum may remain engaged in the orifice for several days, and even project into the upper part of the vagina, before being expelled completely.

When the cause has acted directly upon the fœtus, either mechanically, as by a violent blow or concussion, or physiologically, by destroying to a greater or less extent its vascular connections with the uterus, the subsequent course of affairs is different; for here the phenomena which announce the death of the product of conception are the first to be manifested. After the few hours necessary to dissipate the agitation and fears caused by the commotion she has experienced, the woman feels no pain nor inconvenience; everything is calm, and seems to resume its natural order; but, after the lapse of a few days, sometimes only eight or ten, the movements of the fœtus, which had up to this time maintained their usual force and frequency, become weaker, are separated by longer intervals, and finally become imperceptible. From this moment, the uncomfortable sensations and digestive disorders, which had annoyed the patient from the outset of pregnancy, disappear as though by magic; the swelling of the breasts and prickling sensations which had affected them, also diminish or cease entirely. A miscarriage is then inevitable, for the ovum is a foreign body in the uterine cavity, and soon irritates the walls of the organ by its presence; the latter contracts, and the expulsion is generally effected about eight to nine days after the accident. In this case, the process advances in a more regular manner, because the womb has had time to prepare itself for the act. However, this term is not uniform, it being not at all uncommon for the dead fœtus to remain much longer in the womb: two or three weeks, or a month, for example. I saw a woman at the Clinique, in whom the child's death was clearly ascertained, though she did not abort until six weeks afterwards. Cases are also recorded of the embryo remaining in the womb until the ninth month.

The development of the contractions is solicited by the derangement which this condition of death gradually produces in the placental circulation; indeed, the quantity of blood arriving in the placenta often diminishes by degrees, and ultimately becomes almost nul; but this is not always the case, since, in some instances, the circulation continues, and the placenta enlarges,—attains even to double the volume of that at term, and after its expulsion exhibits the same degree of integrity. Lastly, in other cases, says M. Guillemot, the placenta retains its vitality and grows; but, at the same time, assumes unusual forms, and a singular structure, exhibiting a cavity in which remains of the fœtus are hardly to be found.

Where a long time thus ensues between the period of the child's death and that of its expulsion, there is, in general, less danger from hemorrhage than if the premature labor had taken place immediately. In these abortions, less blood is usually lost than in the labors which come on naturally, after the most favorable gestations; which is probably owing to the fact

that the child's death diminishes the activity of the uterine circulation, especially that of the utero-placental vessels, which must then become obliterated in a great measure, and consequently can furnish but little blood at the time when the placenta is separated.

We have seen (page 558) that the general phenomena experienced by the mother after the death of the fœtus are very singular in these cases, but abortion does not always follow immediately, a variable interval, sometimes a long one, intervening before labor begins. The child born under these circumstances has a peculiar macerated appearance, but no evidence of putrefaction.

But it happens otherwise when, the fœtus being dead, the membranes are ruptured, and the expulsion is delayed; for then a rapid putrefaction sets in, as a consequence of the contact of the child with the external air. A high fever, characterized by the symptoms of a veritable infection, develops itself; a dark fetid liquid oozes from the genital parts, mixed with shreds, in a state of putrefaction; and if the uterine contractions do not speedily relieve the organism from this source of infection, the patient may rapidly succumb under its deleterious influence. Finally, when the abortion is brought on by the existence of two children, the twins are nearly always expelled simultaneously; although we have occasionally known the women to abort of one child in a multiple pregnancy, whilst the other continued to grow.

Hemorrhage is one of the most common symptoms. It may precede, accompany, or follow the expulsion of the fœtus, and is of such frequent occurrence that most authors make it the principal disorder. In some cases it is certainly the cause of the abortion, though often merely a consequence. Sometimes, indeed, the miscarriage is accompanied with but slight hemorrhage. The latter circumstance is, however, rare, especially in the false labors that take place before the end of the fourth month; because a more or less abundant discharge of blood nearly always shows itself during the first expulsive pains, and persists until the uterus is completely emptied; but, as we all know, nothing of this kind is observed in labor at term. M. Jacquemier has happily explained the difference between the two in the following manner: He states that, towards the end of gestation, the placenta spreads out from the centre towards the circumference, in order to conform itself to the uterine enlargement at its greater extent; and this is accomplished in such a way that its different lobes, by separating from one another, have a considerable space left between them.[1] From this it follows, that, within certain limits, the uterine contractions have no tendency to detach it; for the placenta accommodates itself wonderfully to the retraction of the organ until it reaches its own proper limits; and even then its great flexibility permits a further reduction, so as to follow the uterus as it becomes less, before the detachment commences, and this latter phenomenon only takes place when the entire fœtus is nearly expelled. But, prior to the fourth

[1] To convince one's self of the truth of this fact, it is only necessary to see the placenta still adherent to a uterus which has been developed but is not yet retracted, or even the uterine surface this mass occupied; for the latter is nearly one-third larger than the surface of the placenta which covered it. (*Jacquemier.*)

month, the after-birth is far from offering the same conditions; since the thickness of the utero-placental decidua and the large amount of plastic matter interposed between the lobes at that time, confer upon it a much greater density; and therefore it can only yield within very narrow limits, either in the way of extension or retraction towards its centre. Hence, the facility of its separation during the early contractions, the rupture of a certain number of vessels, and the incessant hemorrhage throughout the whole duration of the labor.

ARTICLE III.

DIAGNOSIS.

Judging from the numerous signs just given, the diagnosis of an abortion ought to be very easy; but, unfortunately, these signs are not very clearly marked until the accident is inevitable, and consequently, when it is a matter of indifference to the patient whether the physician makes out a clear diagnosis or not.

It is, therefore, in the beginning of such symptoms, especially, that we should endeavor to recognize their true nature, because then only can our art succeed in arresting their progress; but this is exceedingly difficult.

The diagnosis of abortion involves the solution of several questions. Is the woman pregnant? And, supposing the pregnancy to be determined, are the symptoms those of a simple uterine congestion, or of a commencing abortion? Lastly, is the abortion inevitable?

1. *Is the Woman Pregnant?*—This first question is quite readily resolved after the fourth month of gestation, though before that period it is almost always unanswerable. All practitioners of obstetrical experience are aware of the difficulties which often involve it. Thus, a woman in good health has her courses suddenly suppressed for several months without any appreciable cause, the breasts swell, and the body increases in size: in a word, she experiences several of the phenomena properly regarded as rational signs of pregnancy; then, all at once, at the return of the third or fourth menstrual period, some symptoms of congestion of the uterus appear, last for several days, and are soon followed by a slight flow of blood. How, then, shall we determine whether the pains felt by the patient, and the discharge of blood from the vulva, are owing to a return of the interrupted menses, or to an approaching abortion? The pains attendant on difficult menstruation, especially after a suspension of several months, resemble greatly, both in situation and intermittence, those of abortion. According to Madame Lachapelle, in abortion the uterine orifice is open, the hemorrhage precedes the pains, and the latter persist notwithstanding the abundance of the discharge; whilst in difficult menstruation the orifice is closed, the pains are felt before the hemorrhage appears, and they diminish or even cease entirely when the discharge is well established. The contrary, however, not unfrequently occurs.

Doubtless a strict investigation of the circumstances which accompanied and followed the suppression of the menses, and an examination of the uterus, might lead to an opinion as to the probable state of the case; but

what experienced physician does not know how deceptive are all these rational signs, when we take into consideration the tendency to exaggerations of the females, who so readily believe what they wish or what they fear, as also how nearly the congestion, which precedes and accompanies the suspended menstruation, places the uterus in the same physical conditions as in a commencing pregnancy?

Does the blood escape from the genital parts as a clot? It has been hoped that the shape of the latter might furnish a reliable sign.

It has been stated that the clot driven from the unimpregnated womb exhibits a triangular form, corresponding to that of the cavity where the blood coagulated, which never happens when a product of conception is present; but this may fail, as the clot is mostly changed in its shape by traversing the neck; and, on the other hand, in abortion, the blood may collect and coagulate in the vagina, and the coagulum exhibit the indicated character.

But, if the coagulum be still in the cervix uteri, and supposing the finger is able to reach this point, how can we distinguish whether the foreign body felt there is a clot or ovum? For this purpose, Holl has laid down the following signs: If the finger introduced into the orifice perceives the mass to become tense during the contraction, to augment in volume and advance towards the vulva, it is an ovum engaged in the os uteri; and if it were a clot, it might be recognized by its fibrinous structure; besides, during the pain, its exterior surface would not be more tense, nor more smooth, and it would not appear forced down, but rather compressed; finally, as the ovum resembles a soft bladder, its inferior extremity is rather rounded than pointed, while the coagulated mass is more resistant and solid, is less compressible, and has, in general, the form of a cone, the enlarged extremity of which is above and the apex below.

Finally, if we should then attempt to move the uterus in its totality by pressing on this mass, it might be easily effected if there were a clot concerned, whilst the parietes of the ovum would yield, and would not transmit the motion to the organ which envelops it, and with which it is then but feebly adherent.

The question is therefore by no means simple, yet it is important to know whether pregnancy really exists; for as the appearance of the menses is then of very rare occurrence, especially when they are absent in the early months, a flow of blood should be treated as a serious accident, which, on the contrary, would be promoted, if attributable to a return of the courses. Notwithstanding these uncertainties, there may be a union of circumstances such as to allow of at least a probable diagnosis. Thus, if a woman, who has been habitually regular, finds her catamenia to stop suddenly and unaccountably; if this suppression is followed by other rational signs of pregnancy; if the pains continue notwithstanding the discharge of blood; if they appear as an effect of any violence whatsoever, or if they present any thing unusual as respects either intensity or duration, it may be concluded that abortion is imminent. The diagnosis becomes more certain if the blood flows more profusely than in ordinary menstruation, if it is accompanied with sharper pains in the hypogastrium than is usual, if coagula are

expelled, and if the orifice is sufficiently dilated to admit the extremity of the finger.

2. Pregnancy existing, may the symptoms be attributed to simple congestion of the uterus, or should they be regarded as the first tokens of a threatened abortion? Though it is very difficult to decide this question within the first three or four months, and at the beginning of the accident, its solution is happily of little importance as regards the treatment, the measures indicated by simple congestion being equally applicable to the prevention of miscarriage.

When symptoms, which in all appearance were due to simple congestion, have yielded to proper treatment, the physician is often required to answer a question whose rigorous solution is always impossible: namely, the abdominal and lumbar pains being allayed, and all the other alarming symptoms removed, is the patient therefore out of danger of miscarriage? In the majority of cases we can tell nothing about it, for it is impossible to know whether the congestion has been arrested in time to prevent a rupture of blood-vessels, and an effusion between the placenta and uterus, or whether the separation of the placenta is extensive enough to have destroyed the fœtus immediately; even supposing the child to be still living, we cannot ascertain the degree of separation of the placenta, nor foresee the effect which a partial destruction of its maternal attachments may have upon the fœtus. Very frequently, indeed, the latter, by being cut off from a considerable part of its means of respiration, is placed in the condition of an adult whose lungs are in great measure destroyed, and whose respiration and nutrition being insufficient, gradually wastes away, so the child often does not perish until after the lapse of eight days, two weeks, and frequently even not until the next menstrual period; this, too, without the appearance of any new symptoms to explain its unlooked-for death. The physician cannot therefore be too reserved in his diagnosis, as regards the possible consequences of such accidents.

3. Finally, supposing the abortion begun, can we hope to arrest the symptoms? The intensity of the pains, their constant direction from the umbilicus towards the coccyx, the previous duration of the discharge, and the amount of blood already lost, softening and dilatation of almost the entire neck, and even of the internal orifice, and projection of the membranes during the contraction, doubtless indicate a very unfavorable prognosis, though they should not destroy all hope. All these symptoms conjointly have in fact been known to yield to appropriate treatment, everything to resume the natural state, and the pregnancy to go on as usual. Some authors even state that the rupture of the membranes and discharge of the amniotic fluid does not render abortion inevitable. This last assertion, however, seems to me to be at least very contestable, for it is infinitely probable, not to say certain, that in the cases alluded to there has been a mistake in reference to the true origin of the waters lost by the patient. It appears to me that a rupture of the ovum must inevitably give rise to abortion; and Desormeaux has certainly confounded cases of hydrorrhœa with the true discharge of the amniotic fluid.

A young lady, who had already been so unfortunate as to miscarry in her

first pregnancy, to be delivered of a dead child in the second, and finally to have lost a little girl of six months, had advanced three months and a half in a fourth pregnancy. After returning from mass, in a church very near her dwelling, there was a sudden discharge of fluid from the genital organs, to an amount estimated by the patient at about a tumblerful. On first seeing her, I thought abortion inevitable. Then, upon a careful examination of the uterus, it seemed to me, that, notwithstanding the loss which had occurred, the organ presented its usual size, a certain elasticity, a peculiar suppleness showing that some fluid must still remain within the amniotic cavity; there was nothing peculiar in the state of the cervix; no flow of blood; neither was there pain before, during, or after the discharge of water. In acquainting the patient with the fears which I entertained, I also assured her that all hope was not lost, and that the circumstances just mentioned presented collectively features which do not usually appertain to ruptures of the ovum itself. Absolute quiet, a small bleeding from the arm, opiate enemata, and hand-baths, to be repeated morning and evening, were directed. No new symptoms supervened, and the development of the uterus continued. For the first two days, there was still a very small discharge of water. At four months and a half, and also without appreciable cause, there was a sudden escape of five or six spoonfuls of a fluid similar to the preceding. After this, nothing of the kind occurred until the end of her pregnancy, which terminated very happily. (See *Hydrorrhœa.*)

Abortion is really inevitable only when the fœtus has ceased to live, or when the separation of the placenta and the rupture of the utero-placental vessels are so extensive that the remaining utero-placental attachments are unequal to the support of the fœtal respiration.

In order to estimate the probable degree of disturbance of the utero-placental relations which has taken place, much more regard must be had to the amount of the discharge than to its duration. A simple exudation, or a moderate flow of blood, may continue for several days or weeks, since it may originate in the rupture of very few vessels; I have known it to last for six weeks and two months, without compromising the pregnancy; but that the patient should lose a considerable amount of fluid or coagulated blood in a short time, the placenta must be separated to a considerable extent, and abortion almost necessarily ensues.

There is still another peculiarity not mentioned by authors, which appears to me of importance, inasmuch as it cuts off almost all hope of arresting the progress of the symptoms: I allude to a particular form of the neck. When the patient has been for a short time only pregnant, we know that it is always easy to distinguish the neck of the uterus from its body; in the great majority of cases, we may even feel the angle which separates them. Now, when the contractions have lasted for a certain time, they have gradually dilated the internal orifice; the cavity of the neck has become confounded with that of the body, and when the finger in the vagina is passed over the entire lower segment of the uterus, the neck can no longer be distinguished from it; a well-defined limit between them is no more to be detected, and all that belongs to the neck of the womb has the shape of a pear, the larger part being continuous with the body of the organ, and the

lower extremity corresponding with the external orifice. Whenever I have met with this condition of things, abortion has taken place. "The vagina itself," Dr. Coffin remarks, "is so far affected, that its upper extremity becomes rounded, the rugæ are effaced, and the finger meets everywhere a smooth and regular surface like that of a polished vase."

It is impossible to ascertain certainly in the early months, whether the fœtus be living or dead. I must, however, mention a peculiarity which in my estimation is of great value in reference to this question: namely, the sudden cessation of the vomitings, salivation, or any other sympathetic functional disorder of pregnancy. When, after an accident, vomiting and salivation cease, there is cause to fear that the child is dead, the persistence of these discomforts being on the contrary a favorable sign. Happily, though the uncertainty upon this point makes an exact prognosis impossible, it in no wise affects the treatment. Whenever, indeed, a collective examination of the general and local symptoms leads to the supposition that the child is living, and that we may hope to arrest the progress of the accident, we should act as though we were certain.

We see, therefore, that in the first third of gestation the diagnosis, at the best, can be only probable.

At a more advanced stage of gestation, the diagnosis is much more certain. First, because we can then generally ascertain the development of the uterus without difficulty; then, again, pains are more energetic: the blood flows in greater abundance, and the dilatation of the os uteri is more easily detected; but it becomes still more certain when the death of the fœtus can be verified in a positive manner. (See *Signs of the Death of the Fœtus*, page 558.)

ARTICLE IV.

DELIVERY OF THE AFTER-BIRTH.

The spontaneous expulsion or the extraction of the placenta presents very different phenomena according to the period when the abortion takes place; and, in this respect, it is highly important to distinguish the accident in the first two months from that of the third and fourth, as also from that of the fifth and sixth; for the ovum is usually expelled entire in the first and second months, but in the two latter the expulsion of the placenta is accomplished nearly in the same way as at term. But in the third and fourth months it is altogether different, because the placenta, which is already voluminous, has contracted at this period numerous and very intimate adhesions with the womb, which has not as yet acquired all the contractility of tissue that it possesses at term; consequently the premature contractions, although sufficiently energetic to rupture the ovum, are not adequate to the destruction of the utero-placental adhesions. Hence, under the influence of such contractions, the amniotic sac, being pressed on all sides, yields near the neck, the waters escape, the little fœtus is expelled, and the very delicate umbilical cord breaks easily; at the same time a certain quantity of liquid or coagulated blood is poured out, and very often the small fœtus is lost in the midst of the coagula that accompany its discharge Then the uterus, being partially evacuated, retracts, the neck closes up

and the symptoms disappear; nevertheless, the placenta and membranes are still undelivered, and may remain in the womb for eight, ten, or twelve days, or even longer. Dr. Advena, of Labischin, reports an instance where the after-birth was not expelled till three months subsequent to the abortion this latter having occurred at the fifth month of pregnancy. (*Journal de Chirurgie*, Aug. 1843.)

The complete closure of the neck evidently makes the introduction of the finger impossible, so that every attempt made for this purpose would prove fruitless. Ergot may, indeed, be administered with the object of exciting contractions, though I have never seen it have any good effects when given under these circumstances. To wait, at the same time watching carefully, is all that can be done.

The symptoms which may then result from retention of the placenta are very variable, and should be carefully studied.

1. Very frequently, nothing at all unusual is observed for a few days following the miscarriage. The general health is good; the patient, believing herself entirely cured, gradually resumes her ordinary occupations, when all at once, and without any known cause, some intermittent pains are felt in the hypogastrium, and a little blood escapes from the vulva. The woman often neglects these primary symptoms, but they persist and augment in intensity, thereby constraining her attention to them; for the placenta has become a foreign body in the womb, and, irritating the uterine walls by its presence, excites their contractions; these break up the utero-placental adhesions, and the after-birth is almost free in the uterine cavity. This separation is always accompanied by hemorrhage, which is at times very abundant, because the os uteri dilates with so much difficulty, to permit the foreign body to escape, that the latter, by remaining in the womb, encourages a hemorrhage by irritating the organ and preventing the complete contraction of its walls; insomuch that, if art does not seasonably interpose, life itself may be endangered. What is still worse, if the physician was not present at the time of the miscarriage, and carefully examined all the clots himself, the attendants will tell him that the after-birth and the child were expelled together, and he may possibly overlook the cause of the accident. Consequently, the accoucheur should rely exclusively on his own personal examination. He must absolutely touch the female, when he will usually find the os uteri to be partially dilated, and a portion of the placenta hanging in its orifice. It then is only necessary to seize this portion with the two fingers, for its extraction is, in general, quite easy. In case of necessity, Levret's abortion-forceps, Duges' placenta-crotchet, or Pajot's curette, might be used for this purpose.

[It has always been my practice to remove the whole ovum—fœtus, placenta, membranes, and all—before leaving a patient who is aborting, provided, of course, the uterine canal was sufficiently patulous and no injurious force was required to accomplish my object. To remove the placenta and membranes, I have used preferably my fingers, aided by pressure on the abdominal walls, and when I failed with this method, I have always succeeded in detaching the secundines with a large, blunt curette, and in removing them with the fingers or a long, broad forceps. My reason for this has been that no woman has seemed to me free from the danger of hemorrhage or sepsis, so long as a portion of the secundines remained in the uterus, and I have never had occasion to regret following this practice. (See *Amer. Jour. of Obstetrics*, Feb., 1881.)—P. F. M.]

Sometimes the adhesions of the placenta are so numerous that it is impossible to destroy them. It is then possible, by strong pressure upon the hypogastrium, to depress the womb, so that the forefinger of the other hand can be passed into its cavity, and glided between the placenta and the uterine walls. If this does not succeed, the tampon must be resorted to, and the ergot administered at once; conjoint use of these measures rarely fails to arrest the hemorrhage, and bring on sufficient contraction to expel the secundines.[1]

Such are the measures whenever the hemorrhage becomes dangerous either by its duration or abundance. When, however, it is arrested, especially when the placenta is partially engaged beneath the orifice, and seems to prevent, by its presence there, further discharge, we should wait, and be very careful how we attempt to extract it immediately. The engagement of the placenta in the cavity of the neck maintains in the latter a degree of dilatation likely to facilitate its complete expulsion, and besides exciting, as a foreign body, the sensibility of that part, also excites, or at least keeps up, the contractions of the fundus of the womb. Tractions upon the engaged portions might tear the placental mass at the point of constriction by the retracted internal orifice. Now immediately after this partial extraction, the neck would resume its former condition, the internal orifice would close more or less completely, and render impossible the removal of the portion of placenta remaining in the cavity of the body of the uterus.

2. Sometimes the placenta remains in the uterine cavity after having been separated wholly, or in part, and soon undergoes decomposition, just as though it were exposed to the air; the lochia become fetid; the uterine walls, being in contact with the substances in course of putrefaction, absorb a portion thereof, and, as a consequence, fever is developed, together with all the symptoms of a putrid infection. In these cases, we should evidently relieve the womb from those foul materials that infect the whole economy; unfortunately, the neck of the uterus is completely closed, and an introduction of the finger thereby rendered impossible. Often it is exceedingly difficult to make the extremity of a canula enter for the purpose of throwing detergent injections into the uterine cavity, and we are then compelled to await the complete expulsion of the sanious matters resulting from the decomposition. In such cases, M. Velpeau speaks favorably of the use of ergot. This, indeed, is a remedy that might be used, but from which, nevertheless, we should not expect too much.[2]

A lady, thirty-five years of age, whom I suspected to be pregnant, although she would not believe it, felt a discharge from the parts after a suspension of the menses for two months and a half, which she at first mistook for a return of her courses, but which, after riding out in a carriage, was suddenly

[1] Full doses of the fluid extract of ergot, or subcutaneous injection of ergotine, should be given. It is strongly advised to soak the pledgets of cotton, wool, the sponge, or other material used for plugging the vagina, with glycerinæ or carbolic acid and water (ʒss. to Oj.). The tampon should not be allowed to remain longer than from 6 to 12 hours without renewal.

[2] If, after employing the tampon for twenty-four hours, the cervix remains closed, a *tupelo* tent should be resorted to, never a *sponge*, on account of the danger of septic infection.

converted into a profuse flooding. Having been summoned immediately, I found the os uteri slightly dilated, and I forthwith employed various measures adapted to the arrest of the discharge, and among others the ergot. The hemorrhage gradually diminished, and at ten o'clock P. M. (six hours subsequent to the invasion of the symptoms) it had entirely ceased. During the first five days the patient did very well, but on the sixth I thought I detected a slight odor in the lochia, and at three o'clock in the afternoon a violent chill came on, which lasted an hour. From this moment all the phenomena of absorption were manifested. I immediately administered forty grains of the ergot, but without effect, for nothing came away; and notwithstanding the enlightened efforts of Messrs. Chomel and Moreau, who were several times called in consultation, this unfortunate lady died on the tenth day following the appearance of the first symptoms. At the *post-mortem* examination we found the uterine tissue softened, and its cavity filled by the putrefied and still adherent placenta, which we could not separate without tearing.

3. It may further happen that the placenta, maintaining its vascular adhesion with the internal surface of the organ, continues to be developed after the child's death, the cord and fœtus become atrophied, and then completely destroyed; or, indeed, the ovum may rupture, and the little product escape, leaving the membranes behind. These envelopes may undergo various modifications, but the most common is the morbid product known as a fleshy *mole*. It has been generally conceded, since the researches of M. Velpeau on the subject, that moles which are expelled from the uterine cavity are merely the remains of an altered product of conception.

4. Lastly, there is yet another mode of termination, admitted by Nægèle, Osiander, &c. I allude to the absorption of the placenta retained in the cavity of the womb; for although such an absorption has been observed even after delivery at term, yet most of the reported cases refer especially to miscarriages. (See *Delivery of the After-birth.*)

ARTICLE V.

PROGNOSIS.

The prognosis of abortion is necessarily variable, according to the time of its occurrence and the cause which has produced it. As regards the fœtus, it is always mortal, since the expulsion takes place before the product of conception is fitted for an extra-uterine life, though I am well aware that cases are reported of children, born prior to the period of viability fixed by law, which have lived; but these examples, even were they authentic, are too rare to invalidate the general proposition just laid down.

As regards the mother, the prognosis is said to be more grave than that of labor at term; but this proposition, which has been advocated since the days of Hippocrates, requires explanation, and should not be received without some restriction; for the prognosis, considered in relation to immediate consequences, is certainly less serious in a case of abortion than in a natural labor; but the remote effects are undoubtedly more disastrous in the former case. Thus, the acute diseases which attack lying-in women are more fre-

quent after labor, whilst the chronic disorders of the genital organs which appear in advanced age are more common with females who have often aborted than with those who have always been delivered at term.[1] Again, it is highly important to notice the unfavorable influence that one abortion seems to have over subsequent pregnancies; for whenever a woman has had a miscarriage, she is more predisposed than others to a similar accident, and hence great precautions should always be taken to prevent it.

The period at which an abortion occurs also influences the prognosis, although we cannot exactly say, with Desormeaux, that it is more serious for the patient in the advanced stages of gestation. Doubtless, as before stated, it scarcely constitutes an indisposition in the first or even the second month; but in the third or fourth, the expulsion of the fœtus demands a certain dilatation of the os uteri, and tolerably energetic contractions; for the neck and body of the uterus have not as yet undergone the modifications necessary to such an effort, and the delivery of the after-birth often presents difficulties less frequently met with at a more advanced stage of gestation; whence I conclude, that an abortion is then more grave and painful to the patient, as also more dangerous, than in the fifth or the sixth month.

Lastly, the prognosis varies with the cause of the accident. Thus, the most serious of all is an abortion brought on either by medicines administered internally or by manipulations; while a miscarriage determined by slow and gradual influences is usually attended with less danger than one caused by external violence or some powerful moral commotion. In this latter case, the hemorrhage which precedes, accompanies, or follows the abortion, is nearly always much more serious. Lastly, when it occurs in the course of an acute inflammation of an important organ, or during the existence of an acute disease of the skin, it is exceedingly dangerous.

ARTICLE VI.

TREATMENT OF ABORTION.

The treatment of abortion consists in preventing it, in favoring the expulsion of the ovum when this is inevitable, and in remedying the various accidents that may complicate it.

1. *Preventive Measures.*— When the miscarriage is dependent on the woman's bad constitution, or on a lesion of the genital organs, we must endeavor to combat and destroy this pernicious predisposition, more especially in the intervals between the gestations. I shall say nothing at this time of the means of modifying the general vices of the constitution, since they necessarily vary with the nature of the affection. It is particularly important, however, to bear in mind the disastrous influence of syphilis, whether the father or the mother be infected with it, over the life of the fœtus; and we should persuade them to submit to a mercurial course.

[1] Would it be unreasonable to suppose that, inasmuch as women who have had frequent miscarriages are particularly liable to chronic diseases, the tendency may be due to the fact that they have long borne the germ which occasioned their previous abortions? Which was the cause and which the effect? (Blot.)

When it happens that several abortions have resulted in consequence of some displacement of the uterus, the latter should be remedied by the appropriate measures: for instance, in the commencement of pregnancy, the woman should avoid all fatigue and every violent effort; and it is even advisable for her to remain in the recumbent position until the uterus rises above the superior strait.

We award the proper value to the influence attributed by Desormeaux to the supposed rigidity and excess of sensibility or contractility in the uterine fibre, as well as to the excessive weakness or relaxation in the fibres of the neck. But, whilst interpreting the action of those causes in a different manner, we believe, with him, that bathing, general bleeding, opiate injections, and a regulated course of living, are the means best suited to moderate this great irritability of the organ; and that a tonic and strengthening regimen, aided by the ferruginous preparations, cold baths, and the chalybeate mineral waters, will be the most usefully employed in those cases where the general debility of the patient may have seemed to exercise some influence over her former abortions.

Plethoric women, who usually have profuse menstrual discharges, and who may have previously suffered from abortion at the periods of menstruation, all of which had been preceded by the symptoms of general or local plethora, and all followed by more or less copious discharges, should be subjected before fecundation to a restricted regimen; and during gestation, they should avoid all moral and physical excitements, and should remain in bed eight, ten, or even twelve days at every monthly term; besides, they ought to be bled several times during the earlier periods of pregnancy, more especially just before the time for the menses to appear.[1]

These, more than other pregnant women, should renounce the use of corsets, which, independently of the restraint they make on the development of the breasts, oppose the free return of blood, by interfering more or less with the abdominal and thoracic circulation, and thereby favor congestion of the inferior organs.

Feeble, cachectic females, who are impaired by former diseases, and those whose tissues are soft, and their circulation languid, or who, from being habitually irregular, are affected with chronic leucorrhœa, are often attacked by hemorrhages during pregnancy which ultimately lead to an abortion.

In such patients the face is pale, the pulse soft, small, and irritable, the tongue white, digestion painful, the intestines torpid, and the extremities cold. The least exercise fatigues them, sometimes even exhausts their strength. The fatigue is often accompanied by a sensation of weight, of painful draggings in the groins and lumbar regions, and, should they remain standing for any length of time, the uterus seems to require some support, as it appears just on the point of escaping by the vagina or rectum. Even in the

[1] The physician often meets with much opposition from persons out of the profession when he proposes a preventive bleeding in the early stages of gestation. Particularly, should any accident happen shortly afterwards, they would not fail to reproach him with it. This, however, is no just reason for not acting according to his convictions, or for yielding in cases where he believes it really useful. Now, experience has fully proved that, in such instances as those we have described, it is one of the best preventive measures.

earliest stages, they feel something like a weight in the lesser pelvis, always pressing on the most dependent part.

Now, the best mode of preventing such a condition, is to prescribe a tonic regimen, together with the ferruginous and bitter preparations. Canella, in powder, has been recommended; and Sauter highly extols the use of powdered savine; he asserts, that he has succeeded in correcting this pernicious predisposition in pregnant women, who had previously had several miscarriages, by administering fifteen grains of the powder three times a day, continuing it for three or four months; by this remedy he has arrested flooding and prevented abortion, and many patients can attribute the fact of having children born at full term to the employment of this precious drug.

White, of Manchester, has particularly recommended cold bathing, especially sea-bathing, to be often repeated, both before and during pregnancy.

The accoucheur must therefore search in the history of former miscarriages for the indications to guide him in the use of preventive measures; and it is likewise very important that he should make himself acquainted with all the accompanying circumstances.

Pregnant women are very often constipated, and this constipation frequently becomes the cause of periodic abortions, by the irritation it produces; hence, it should be prevented by the use of some simple injections, with the addition of one or two tablespoonfuls of linseed-oil, regularly, every other day, for two weeks before the period when the abortion occurred last time, and they ought to be continued for two weeks after it.

But whatever may have been the predisposing cause whose influence was exerted in the previous pregnancies, there is one very important precaution, the neglect of which might render all others useless. In all cases where abortion has occurred several times, it is indispensable that the organ should remain undisturbed, and the husband be recommended to allow from six to eight months, or even a year to elapse, without the wife being exposed to become pregnant.

When this accident has already occurred a number of times in former pregnancies, it is always indispensable for the woman to abstain altogether from intercourse with her husband, for all sources of irritation must evidently be withdrawn from the womb. Again, if the fœtus was expelled dead in the preceding gestations, and this death had been caused by some lesion of the ovum, it is almost impossible to recognize, and consequently to prevent, a similar alteration.

The case is rather different when the previous abortions have been attributed to utero-placental or intra-placental effusions, for these are almost always the result of a congestion of the uterus, of sufficient intensity to produce a rupture of vessels. In another pregnancy, it might be possible to avoid such accidents. We would, however, call attention to the fact, that these local congestions may occur in chlorotic as well as in plethoric women, and consequently, that, although revulsives applied to the upper part of the body, or to the superior extremities, are useful in all, bleedings from the arm at the menstrual periods are very advantageous with the latter, whilst the former are benefited by the preventive use of ferruginous preparations, administered from the commencement of gestation.

Under some unfortunate circumstances, nature seems to deride all the attempts of art, and abortion reoccurs. Still, we must not despair when the woman becomes again pregnant, for experience fully proves that, notwithstanding numerous former abortions, a fresh pregnancy has sometimes succeeded in reaching full term. Dr. Young (*Rigby*, 91) relates, in his lectures, the history of an unfortunate lady, who, after having had thirteen successive abortions, became pregnant for the fourteenth time, and was happily delivered of a living infant at term.

But, notwithstanding all these precautions, it sometimes happens that an abortion is threatened. The patients are affected with shiverings from the most trifling causes, pains in the hypogastrium, loins, &c.; uterine contractions appear, the sexual parts become moist, and occasionally even the os uteri dilates; but even here we must not lose all hopes of arresting the accident, notwithstanding those symptoms.

If the patient is robust, the pulse full and frequent, more especially if the development of the symptoms had been preceded by indications of plethora, bleeding in the arm should be at once resorted to, the woman be laid as horizontally as possible, and opiates immediately administered. The laudanum of Sydenham may be given in the dose of twenty, forty, or even sixty drops, diffused in a small quantity of some mucilaginous liquid as an injection, and repeated at intervals of an hour, until the contractions disappear. This remedy, of which we have before spoken, is one of the most efficacious in cases of this kind, and sometimes it alone has enabled us to arrest a labor whose termination seemed to be inevitable, and thus has permitted the gestation to pursue its regular course.

I cannot refrain from citing the following instance in illustration. A woman, advanced to three months and a half, was taken with pains in the abdomen and loins, after a violent altercation with her husband; on the following day the pains augmented, and a little bloody fluid escaped from the genital organs; the pains still continuing, and the discharge having somewhat increased, on the third day the patient came on foot to the Clinique. I found on her arrival that the uterine contraction was very distinct, the pains sharp, and renewed every eight or ten minutes; pure blood was discharging from the vulva, and the orifice was sufficiently dilated *to permit the finger to pass readily as far up as the naked membranes.* I administered sixty drops of laudanum, divided into three doses, which were given at intervals of three quarters of an hour, and by the end of this time the pains disappeared, everything resumed its natural order, and the gestation went on till full term.

I might multiply such citations almost *ad infinitum*, but the above is sufficient to show that, however inevitable the abortion may at first appear, we should never abandon all hopes of preventing it. I may add, that the administration of opium in the doses just indicated, or even carried to a hundred drops in the twenty-four hours, has never been followed by serious consequences. Sometimes, perhaps, a little somnolency or heaviness about the head, or a general torpor may result, but which a few glasses of lemonade will soon dissipate. For, after all, when even death of the fœtus must have been either the cause or the effect of the primary symptoms, what do we

risk in calming or arresting the uterine contractions? because, as we have already seen, the dead child may remain long within the intact membranes without any unfavorable consequences resulting to the mother. And besides, as it is almost impossible to ascertain its death with any degree of certainty prior to the fifth month of gestation, we must act in such doubtful cases just as if it were living; although there can be no question that, if the fœtus were really dead, it would be better to permit the contractions to go on, and its expulsion to be effected. But, even supposing these are wholly suspended, the expulsion is somewhat retarded, and that is all; for after the lapse of a certain time the fœtus, acting like a foreign body in the uterine cavity, will irritate its walls, and a new labor sooner or later take place in consequence.

To these remedies (the venesection and opiate treatment) we must add strict confinement to bed, absolute rest of mind and body, the use of demulcent beverages, cold lemonade, veal-broth, chicken-water, and the application of cold compresses, frequently renewed, over the abdomen; which compresses are to be saturated with some fluid whose temperature is progressively lowered. "Local bleedings," says M. Gendrin, "are too much neglected, especially in the treatment of the utero-placental hemorrhages; indeed, we have so often had occasion to congratulate ourselves for having advised them in those cases, that we now prescribe them with great confidence whenever the general condition does not directly indicate a depletory venesection. We direct them: 1. When there are any sharp pains in the neighborhood of the uterus or groins, and we apply them to the latter, the anus, or even the vulva; 2. In cases of a considerable turgescence of the hemorrhoidal tumors (if any such exist); and 3. In the phlegmasia of the adjacent organs, such as the large intestine, &c."

In these two latter cases we fully coincide in the opinion of M. Gendrin; but, in the first, we should much prefer having recourse to a general bleeding in the arm, or, as he himself advises, further on, to the application of leeches at a distance from the uterus: for instance, near the breasts, armpits, &c., &c. Finally, to the means already enumerated, we must further add the use of irritant revulsives, placed upon the upper part of the trunk and the thoracic extremities, and must also recommend in a more special manner the application of dry cups, the decidedly beneficial effects of which we have often witnessed in cases where uterine plethora seemed to be the cause of the symptoms, but where the general condition required some precaution in the use of blood-letting.

2. It has been already stated that a copious hemorrhage, intensity of the pain and of all the other phenomena, and more particularly a rupture of the membranes, render abortion thenceforth inevitable; and hence, the only course in such cases is to facilitate the expulsion of the product of conception. But still, if the hemorrhage is not of such a character during the first three months of gestation as to compromise the woman's life, the physician should remain a simple spectator of the efforts of nature, and confine himself to superintending the progress; for the expulsion of the ovum ought to be left entirely to the uterine forces. Sometimes it comes away whole, which is a very favorable circumstance. Moreover, according

to the recommendation of Baudelocque, he should be very careful not to rupture the membranes, for that would only retard the delivery of the placenta, and render it still more dangerous. In fact, when the fœtus escapes alone, this latter might be attended with the difficulties pointed out in one of the preceding articles.

We should here remember how slowly the expulsion of the ovum is effected in certain cases, even when the orifice is sufficiently dilated to oppose no obstruction to its exit. This great slowness is sufficiently explained by the slight contractile power of the uterus. When no accident complicates the abortion, the physician has nothing to do but watch the progress of the labor, and expect the complete delivery to be effected by the uterine efforts. At a more advanced period, that is, towards the fifth or the sixth month, the course of the physician is very nearly the same as it would be at term. The size of the fœtus, which has now become quite large, requires a greater dilatation of the os uteri; and this, in consequence of the greater softening of the cervix, is accomplished with somewhat greater rapidity. Generally, it is necessary that the child should present one or the other extremity of its long diameter to the os uteri; however, it sometimes happens that some portion of its trunk presents there, and its delivery is neither much more difficult nor much slower than usual. It is in such cases especially that the mechanism of spontaneous evolution may be frequently observed. The delivery of the after-birth does not, as a general rule, exhibit those difficulties which it presented in the earlier months; in truth, it closely resembles the same process in the labor at term.

3. Hemorrhage is not only one of the most common symptoms, but it may follow the expulsion of the fœtus, and become the most serious feature of the case.

Whenever, notwithstanding the use of general measures, such as the horizontal position, cold drinks, the application of refrigerants to the hypogastrium or thighs, and the administration of opiates, the discharge of blood continues so great as to endanger the mother's life, an abortion thenceforth becomes inevitable, and the primary object of the accoucheur should be to bring on the contractions and the evacuation of the organ.

He should also administer general stimulants to sustain the woman's strength, and, at the same time, those medicines having an immediate action on the womb itself, such as the tincture of canella, &c., but above all the ergot. However, when the miscarriage comes on at an early stage of the gestation, these measures are often ineffectual, for it is then exceedingly difficult to excite the contractions of a viscus whose muscular organization is still so imperfect; or at least, if they are aroused, they are frequently inadequate to dilate the neck sufficiently. The tampon is then the only resource; this, when well applied, acts in two ways: 1st, by opposing the escape of the blood externally, thus forcing it to coagulate, and consequently to obliterate the bleeding vessels; 2d, by irritating the womb by mere contact, thereby determining its retraction, and the expulsion of the product of conception. This circumstance, indeed, is one of the best-founded objections to the use of the tampon in the early months of gestation. But, in truth, is it not rather an advantage than otherwise? because the cessation of the flooding is always a necessary consequence of the

uterine contractions; and is the mother's life bought too dear, when it is saved by the expulsion of a fœtus which, in most cases, is dead even before the application of the tampon? Besides, this measure is not always necessarily followed by abortion. Again, there is no reason to fear the conversion of an open into a concealed hemorrhage by the employment of the tampon, before the sixth month; for, notwithstanding the observation of Chevallier, the accumulation of a large quantity of blood in the womb would seem to be impossible at this early period, without supposing an abnormal relaxation of its walls. Where, however, the pregnancy is advanced to the fifth month, the accoucheur should carefully watch the body of the uterus after the tampon is applied, and assure himself, every moment, that its volume is not increasing.

We shall describe hereafter (see *Operations*) the mode of applying the tampon, but it should be remembered that its use is almost always followed by abortion, and that it should be had recourse to only when the latter seems to be inevitable.

When the ovum remains intact, and the labor lasts too long, the continuation of the hemorrhage being at the same time such as to cause serious anxiety, some practitioners prefer rupturing the membranes to applying the tampon. This measure, to which I shall again allude in speaking of hemorrhage during the last three months, does not seem to me applicable before the sixth month, except in a few occasional instances, and I should, in general, decidedly prefer the tampon to it.

In fact, a rupture of the membranes is necessarily followed by miscarriage; but the tampon, when early applied, leaves some hope that the gestation may continue till term; again, the tampon always arrests the bleeding, whereas, after rupturing the membranes, it may happen that the uterus, whose muscular fibres have not acquired the contractile power which they would have at a later period, might not retract, nor the hemorrhage cease, so that it might still be necessary to have recourse to the tampon.

Finally, let us add that, in the first three months, the rupture is followed almost immediately by a discharge of the waters and the escape of the fœtus; but the expulsion of the placenta and membranes is thereby rendered much more difficult.

After the complete expulsion of the ovum, the patient must observe the same precautions as are required after ordinary labor.

CHAPTER VI.

OF EXTRA-UTERINE PREGNANCY.[1]

THE fecundation, as elsewhere stated, most frequently takes place in the ovary, and the impregnated ovule is then received by the fimbriated extremity of the tube, which applies itself on this organ, doubtless by a kind of spasmodic contraction. Having been once deposited in the tubal canal, the ovule traverses its whole length, and falls into the uterine cavity, where its

[1] See page 1165.

development continues until term. Such is the course observed in *normal* or *uterine pregnancy;* but it may happen that the ovule is arrested, or diverted, in the route it thus travels, and ingrafting itself, so to speak, upon the point of stoppage, is there developed; in the latter case, the pregnancy is called an *abnormal,* or an *extra-uterine* one.

This species of gestation has been subdivided into several varieties, which have received different names, according to the part of the passage where the ovule becomes fixed. Dezeimeris admitted the following divisions, namely:

1. Ovarian pregnancy.
2. Sub-peritoneo-pelvic pregnancy.
3. Tubo-ovarian pregnancy.
4. Tubo-abdominal pregnancy.
5. Tubal pregnancy.
6. Tubo-uterine interstitial pregnancy.
7. Utero-interstitial pregnancy.
8. Utero-tubal pregnancy.
9. Utero-tubo-abdominal pregnancy.
10. Abdominal pregnancy.

Such was the classification which, in an anatomo-pathological view, was adopted in the six first editions of this work. We now think it would be better to make a more simple arrangement, and shall, accordingly, describe but five varieties of extra-uterine pregnancy:

1. Abdominal pregnancy.
2. Tubo-abdominal pregnancy.
3. Tubal pregnancy.
4. Interstitial tubo-uterine pregnancy.
5. Utero-tubal pregnancy.

1. *Abdominal Pregnancy.*—To render fecundation possible, it is necessary that there should be direct contact between the sperm and the ovule, and, consequently, that the Graafian vesicle should burst into the abdominal cavity of which it, for the moment, forms a portion. But, should the fecundated ovule, instead of engaging in the tube, remain in the just ruptured ovisac and be retained at the surface of the ovary, or fall into the peritoneal cavity, its development gives rise to an extra-uterine pregnancy which we shall designate under the general name of *abdominal pregnancy.* Three varieties of this class will be recognized: in the first, the fecundated ovule is still contained in the just ruptured ovisac, and is developed upon the spot: the pregnancy is then styled *internal ovarian.* In the second variety, the fecundated ovule, having escaped from the Graafian vesicle, adheres to the surface of the ovary, where it undergoes development: this is called *external ovarian* pregnancy. Finally, should the ovule, after leaving the ovary, attach itself to some part of the peritoneum, it receives the name of *peritoneal pregnancy.*

In *internal ovarian* pregnancy, the ovum is developed within the ovary itself. This variety has given rise to numerous scientific discussions, inasmuch as it was for a long time admitted that the ovule could be fecundated

without previous rupture of the Graafian vesicle. Amongst the observations pleaded in favor of this hypothesis, one related by Bœhmer ought to be mentioned. He describes with much care both the membrane proper of the ovary itself and its peritoneal envelope. M. Velpeau, however, very justly observes that it is often extremely difficult to determine precisely the point of departure of the tumor; therefore we admit with him that, in this species of pregnancy, the ovisac is always ruptured. If the minute wound resulting from it be not evident when the dissection is made, it is because it has been obliterated by the process of cicatrization and the production of a newly-formed membrane.

External ovarian pregnancy cannot be doubted. It is, relatively speaking, quite common, and the fecundated ovule retains its intimate connections with the ovary upon which it is applied whilst undergoing development in the abdominal cavity.

Peritoneal pregnancy was for a long time contested, but is now supported by so great an array of facts, observed both in women and animals, that it is impossible to deny its occurrence. It has, doubtless, often been confounded with the ovarian and other forms, but in several published cases there can be no question that the ovum had no connection with the internal generative organs. M. Dezeimeris makes two varieties of this form of pregnancy, viz.: *primitive* and *secondary*. In the former, the product of conception has never been located elsewhere than in the peritoneal cavity, into which it fell on quitting the ovarian vesicle; in the latter, on the contrary, the first development of the ovule took place in the ovary, the tube, or the walls of the uterus, but at a later period extreme distention or pathological alteration of the walls of the tumor caused their rupture, and the ovum being partly or wholly expelled from the containing cyst, became lodged in the cavity of the abdomen, where it was at last found. The secondary abdominal pregnancy of M. Dezeimeris is, therefore, merely a tubal or interstitial pregnancy, ending in rupture of the primitive cyst. Whether, therefore, this rupture occurs at a very early period or at the regular term of gestation, it deserves to be regarded merely as an epiphenomenon, and can, in no case, constitute a distinct variety. We apply, therefore, the name *peritoneal pregnancy* to that form in which, from the very outset, the ovule has become adherent to some part entirely distinct from the internal generative organs. The points at which it may thus attach itself are extremely numerous, so that the placenta has sometimes been found inserted upon the peritoneum, covering the right or left iliac fossa, sometimes to the mesentery, or to a part of the small and large intestine, and sometimes, finally, to the anterior wall of the abdomen.

Most of the cases described by Dezeimeris as *sub-peritoneo-pelvic* pregnancies belong, we think, to the peritoneal variety. The author applies the former name to cases in which the ovule was unable, after leaving the ovary, to engage in the external opening of the tube, but slipped between the two layers of the broad ligaments and was developed there. According to his view, the ovum here is outside of the peritoneum, and remains principally in the pelvic cavity. Cases of the kind, he thinks, are not rare, and, on account of the situation of the ovum, are to be reckoned amongst the least

dangerous. The position is, indeed, remarkably favorable to the spontaneous expulsion of the débris of the fœtus, or makes them easily accessible in case it should be thought necessary to abstract them. Whilst accepting this prognosis, we think that Dezeimeris is in error as regards the slipping of the ovule between the two layers of the broad ligament; it seems to me impossible that it should follow this route. The observers were, in these cases, deceived by the fact that upon opening the abdomen the peritoneum of the lesser pelvis seemed to be raised by a subjacent tumor. The appearance, however, misled them, for the tumor is not, really, covered by the peritoneum, but by a newly-formed false membrane, which soon acquires the shining and polished appearance of a serous membrane, and which blends, without a well-marked line of demarcation, with the surrounding peritoneum. If this pseudo-membrane be incised, a careful dissection will reveal the true peritoneum below the fœtal cyst. The tumor, therefore, is not extra-peritoneal, but intra-peritoneal. In short, the same phenomenon occurs here which for a long time sustained the idea that retro-uterine hematocele was seated outside of the peritoneum.

2. *Tubo-abdominal Pregnancy.*—It is evident that, if the tube be obliterated near the enlarged extremity, the ovule which has scarcely entered its canal will be arrested; and if the development occurs at this point, the tubal walls will necessarily be dilated, and one portion of the surface of the ovum be free in the abdominal cavity; to this variety the name of *tubo-abdominal* is applied. The placenta is attached in the interior of the tube, and the fœtus developed in the abdominal cavity, and both are surrounded by a cyst, the walls of which are partly made up by the parietes of the tube.

We include in the tubo-abdominal pregnancies those cases which have been described under the name of *tubo-ovarian.* In this the cyst, which surrounds the fœtus, is formed partly by the ovary, and partly by the opening of the dilated tube, whose extremities have contracted some adhesions with the ovarian tunic.

The following case of Dr. Jackson's is justly quoted by M. Dezeimeris as serving for a type. A woman, aged thirty-two years, was seized, in consequence of a violent blow on the epigastrium, with some inflammatory symptoms, to which she speedily succumbed; at the autopsy, a large quantity of blood was found diffused in the abdomen, and a fœtus of about ten weeks was found enveloped in an enormous clot; the fundus uteri rested against the pubis, and its cervix near the middle of the sacrum. This change from its natural position had been produced by a tumor situated on the left side of the womb, which tumor was formed by the ovary, the Fallopian tube, and the broad ligament, that had become considerably thickened and modified in their structure; the fringed extremity of the tube adhered intimately to the ovarian envelope, and a cyst was formed by these two organs, whose distention by the body contained therein had produced the rupture.

In another case, related by Bussières, which seems to me equally conclusive, the tube on the right side was extremely dilated at the extremity; and this dilatation, which was an inch in its largest diameter, extended for rather more than an inch and a half in length, gradually diminishing as it approached the womb. The portion of the tube thus dilated was curved

on itself, and embraced nearly the whole ovary, to the membrane of which it was so adherent that it could not be separated without rupturing the attachments. An unctuous, limpid fluid escaped as soon as it was opened, and then the ovum appeared, which was about the size of a hazlenut, and was surrounded by the liquid; three-fourths of it had already escaped from the hole made in the ovary, so that it no longer seemed to rest there; yet, on attempting its removal, it was found attached by a hard pedicle covered with blood-vessels.

3. *Tubal Pregnancy.*—This is the most frequent of all the varieties of extra-uterine pregnancy; which fact is readily accounted for by the length and narrowness of the canal, and by the adhesions and morbid obliterations presented by its walls. Under such circumstances, the ovule is arrested and developed at some point between its abdominal extremity and the spot where it enters the uterine parietes; and by its continual growth distends enormously the fibres of the tube which constitute the envelope of the fœtal cyst. To the numerous cases of this kind reported by Velpeau and Dezeimeris, I might add another, already published by me in the *Bulletin de la Société Anatomique*, but so many examples are everywhere met with that it seems useless to reiterate their details. Dr. Lesouef's thesis may be advantageously consulted on this point.

4. *Interstitial Tubo-uterine Pregnancy.*—In this case the ovum is arrested in that part of the tube which traverses the thickness of the uterine walls; and although this is its principal characteristic, two varieties have been made of it, of which we shall say a few words.

In the first variety the walls of the tube, yielding to the distention occasioned by the development of the ovum, press back the surrounding tissue proper of the uterus, but always form the most internal layer of the cyst in which the product of conception is enclosed.

In the second variety the ovule reaches that part of the tube which traverses the uterine walls; but having arrived there, it opens a way through the tubal parietes, penetrates into the midst of the fibres of the womb, and thenceforth has no further relation with the tube; hence, the surrounding cyst is formed by the muscular fibres of the womb alone.

After having been once located among the uterine fibres, the ovum may either take an inward or an outward direction, and consequently may become seated near the mucous layer, or else to the peritoneal coat. In a preparation belonging to M. Pinel Grandchamp, the volume of the uterus was about the same as at six weeks or two months of pregnancy; at its left angle, a small tumor, slightly ruptured behind, constituted the cyst containing the product of conception. The tube, which passed behind it, communicated with it by an almost microscopic orifice, and presented nowhere any increase of calibre. The cyst was about large enough to contain an almond.

5. *Utero-tubal Pregnancy.*—Notwithstanding the free communication existing between the tube and uterine cavity, there is no absurdity in the supposition that the ovule may become deposited in a little depression of the mucous membrane, and there stop and ingraft itself, just at the internal orifice of the canal. In this case, phenomena similar to those of the tubo-abdominal gestations will arise: that is, the ovule, which may have con-

tracted some intimate adhesions with this extremity, may, by its development, encroach upon the uterine cavity itself; and I do not hesitate, therefore, to consider this variety of gestation as possible.

It is probable that certain singular cases described by Dezeimeris under the name of utero-tubo-abdominal pregnancies belong properly to tubo-uterine pregnancies. In this variety, examples of which have been furnished by Patuna, Hunter, and Hoffmeister, the fœtus is found in the abdominal cavity; the cord leaving the umbilicus enters the Fallopian tube, traverses its whole length, and is inserted in the placenta, which itself is attached to the internal surface of the uterus.

We explain them by supposing the existence of a tubo-uterine pregnancy ending in rupture of the tube with passage of the fœtus into the peritoneum whilst the placenta remains in the uterus. The cord traverses the tube in its passage from the fœtus to its placenta.

We have not been able, from the restricted limits of this chapter, to bring forward a larger number of cases, but sufficient has been said to furnish an idea of the importance that ought to be attached to the different varieties of extra-uterine pregnancy admitted by us.

The reader may consult with benefit the article of Professor Velpeau, in the fourteenth volume of the *Dictionnaire de Médecine*, the learned memoir published by M. Dezeimeris, in the fourth year of the *Journal des Connaissances Medico-Chirurgicales*, and the able articles of Messrs. Breschet, Menière, and Guillemot.

Other writers have made fewer divisions in the classification, and the subject has been more recently and thoroughly studied. Playfair makes four classes of extra-uterine gestation: 1st, tubal; 2d, abdominal; 3d, ovarian; and 4th, two varieties in which an ovum is developed either in the supplementary horn of a *bi-lobed uterus* or in a *hernial sac*.

Prof. T. G. Thomas, of New York, whose successful operations are well known, believes that "in the commencement of its development the impregnated ovum never attaches itself to, nor draws its nourishment from, any other parts than those lined by the mucous membrane of the uterus or tubes. Knowing, as we do, the delicate and subtle connections which the chorion establishes with the maternal tissues, it is certainly difficult to believe that an impregnated ovum, falling free into the peritoneal cavity, or detained within the Graafian vesicle, can, with parts so unlike the lining of the uterus, establish relations almost identical with those which are normal."

Puech, *Annal de Gynæc*, July, 1878, gives two varieties of ovarian pregnancy. In one the fœtus has developed in a vesicle which has remained open after fecundation, the other in which the vesicle had closed. Most of the cases he regards as either dermoid cysts, ovario-tubal pregnancies, or abdominal pregnancies with placenta attached to the ovary.

The best contribution that has yet been made to the subject is unquestionably the work of Parry, in a volume published in 1876.[1] According to this author, there are three species of extra-uterine pregnancy—tubal, ovarian, and ventral or abdominal—with varieties of each, as expressed in the following schedule (*loc. cit.*, page 49):

[1] *Extra-uterine Pregnancy; Its Causes, Species, Pathological Anatomy, Clinical H etc., etc.*, by John S. Parry, M. D. Philadelphia: 1876.

Species	Varieties.
Tubal pregnancy.	*Tubo-ovarian* (the germ being arrested in the pavilion, which contracts adhesions with the ovary). *Tubo-abdominal* (germ arrested in the same locality. The tube may contract adhesions with neighboring organs. If it does not, the chorion may project into the abdominal cavity, with a part of its surface bare). *Tubal proper* (germ arrested between the pavilion and that portion of the oviduct which traverses the uterine wall). *Tubo-uterine* (germ arrested in that portion of the tube which passes through the uterus).
Ovarian pregnancy.	*Ovarian proper* (germ contained in the ovary; that organ remaining free from adhesions). *Ovario-tubal* (germ contained in the ovary, which contracts adhesions with the pavilion of the tube).
Ventral or Abdominal pregnancy.	*Primary* (ovum developed from the outset in the peritoneal cavity). *Secondary* (development commences in the tube or ovary, the cyst ruptures, ovum escapes, and continues to live and develop in the peritoneal cavity).

From an analysis of 500 cases, he gives the following classification: "After excluding all cases of recovery by discharge through the abdominal wall, the alimentary canal, or genito-urinary tract; many cases of recovery after gastrotomy, in which the variety of the gestation was supposed to have been determined, during the hurry and dread of a critical operation; all cases of vaginal section which were not fatal, and all cases in which the appearances discovered at the autopsy were not described with sufficient care to warrant the deduction of correct conclusions:"

Tubal.	The ovum being developed in the tube proper	149	214
	The ovum being developed in the pavilion: the tubo-ovarian and tubo-abdominal varieties	34	
	The ovum developed in uterine portion of tube: "interstitial" or tubo-uterine pregnancy	31	
Ovarian			27
Abdominal			29
Doubtful			230

§ 1. Pathological Changes.

A. *Product of Conception.*—In these pregnancies the ovule has its proper membranes, the chorion and the amnion. I may state that I was utterly astonished to hear several honorable members contend, in a recent discussion before the Academy of Medicine, that the envelope of the ovule, in abdominal gestations, was only composed of the amnios, and that no chorion existed; for although, in certain very old pregnancies, the most exterior fœtal membrane is confounded with the walls of the cyst, it is not fair to conclude from thence that it did not exist at the commencement.

The absence of the chorion supposes that of the allantois, and without the latter no circulatory relations can be established between the embryo and its mother.

In the so-called sub-peritoneo pelvic gestation, or whenever the ovule, that was originally located in the ovary, tube, or even the uterus, is transferred, after the rupture of the cyst which inclosed it, to some part of the abdominal cavity, there is besides a pseudo-membranous cyst, representing the uterine decidua, produced by the inflammation which the presence of the ovule determines around it. But this enveloping membrane, the cyst, does not exist in primitive peritoneal pregnancies. M. Dezeimeris thus explains the latter circumstance: When a fecundated ovule gets into the abdominal cavity immediately after quitting the ovary, we can readily believe that a corpuscle so minute, soft, and fragile could only produce a very slight irritation at the point of arrestation, and that the extent of this excitation will not pass beyond the limits of contact with the little foreign body; in a word, it cannot produce an acute inflammation, or extensive adhesions, nor an exudation of plastic lymph sufficient to form an enveloping cyst. Now, if it has not primarily caused all these derangements, the neighboring organs will not be injured by its ulterior development, because they become gradually habituated thereto; and the ovule, having obtained a right of possession, lives, grows, and presents to the smooth, polished surfaces which touch it, a surface equally smooth, polished, and moistened at their expense: and not having occasion for any other protecting envelope, no cyst is formed. But when a voluminous product of conception suddenly bursts, and its contents, placed at first like it in the tube or ovary, are transported to the peritoneal cavity, the ovule becomes there a foreign body, wounding and irritating the abdominal organs which are unaccustomed to its vicinity, and determining an acute inflammation around it, which results in the exudation of plastic lymph; this, by coagulating, forms a cyst, and completely isolates the foreign body. If, under these circumstances, the displacement of the fœtus is such that it completely escapes from the amniotic cavity, and suddenly locates itself with its surrounding liquid in the midst of the intestinal mass, an inflammation occurs, and the cyst we have just described forms around it; the new cyst then completely environs the fœtus. But in some cases the displacement is not so complete—the largest part of the trunk may still remain in the amniotic cavity after the rupture, a portion only being displaced, and the latter alone first determines an inflammation around it, and then the exudation, which is transformed into a false membrane; this, by uniting with the lacerated margins, forms only a part of the fœtal cyst, the remainder being constituted by the old fœtal envelope, the walls of the Fallopian tube, for instance, in the case of a tubal pregnancy. The same relations may be established with the membranes of the ovule when the chorion and amnion are ruptured at an advanced period in a case of primitive abdominal pregnancy. For instance, in a case cited by M. Dubois, the cyst that inclosed the fœtus was formed of a membrane which was not altogether uniform in its structure and appearance: thus, for the greater part of its extent, the internal surface was of a light-brown color, owing perhaps to the imbibition of the adjacent liquids, and simulating, both to the touch and sight, the aspect of the mucous membrane of the small intestines, or, still better, the accidental membranes that occasionally line fistulous canals; while at other points, those for instance which were

near the circumference of the placenta, and on the largest part of this surface, the cyst was more smooth and polished; presenting, in fact, the ordinary appearance of the amnion.

The cyst was simple, and about a fourth of a line in thickness at the part where it exhibited the brown and villous character above alluded to; but on the contrary, where the surface was smooth and polished, it evidently consisted of two membranes (the chorion and the amnion.)

In all cases, numerous and large vessels form in the walls of the cyst whose rupture it is evident must give rise to hemorrhage, which very often proves fatal to the mother.

When an extra-uterine pregnancy is somewhat prolonged, these envelopes are sometimes destroyed, being perforated with fistulous canals, communicating directly with the intestinal canal, vagina, bladder, uterus, or an external abscess. At times, the destruction of the cyst is partial, at others complete; so much so, indeed, as to leave in certain cases no vestiges of its former existence; on the other hand, the envelopes sometimes undergo osseous or cretaceous transformations, which may convert them into solid shells. As a general rule, the fœtus exhibits nothing peculiar in its development: for example, in several cases studied anatomically a long time after the term of pregnancy, the osseous system appeared to have a better development than in the ordinary child of nine months. The existence of several teeth has frequently been noticed, or else traces of the eruption of these little bones, which would seem to afford an indication that the fœtus continued to live and grow beyond the ordinary term of gestation.

The most common of the numerous alterations which it may undergo, is the putrescent dissolution of its soft parts, from macerating in a compound of amniotic liquor, blood, and pus; the separation of the various pieces of its skeleton, and their discharge through the divers routes just mentioned. At other times, it seems to have undergone a kind of mummification, a complete drying-up. Again, in other cases, all the tissues appear to be transformed into an osseous or cretaceous substance, or into one resembling adipocire,—and here, it is doubtless unnecessary to add, it is no longer possible to discover any trace of the fœtal membranes.

B. *Tissues of the Mother.*—Some very large vascular canals are seen to develop themselves in those parts where the ovum is attached, however devoid of blood-vessels they might have been previously; and several great veins are found to ramify under the peritoneum towards the circumference of the placental attachment; and where the ovary or the tube happens to be the seat of pregnancy, it presents a soft tissue, apparently fungous in character, and impregnated with blood.

The womb does not continue so indifferent to the advancement of the extra-uterine pregnancy as might be supposed; for its volume increases in a remarkable degree, the tissues become softer, and the mucous membrane hypertrophied and more vascular, so as to form from the outset a true decidua. M. Velpeau, however, disputes this last assertion; but I have endeavored to refute his opinion in the *Bulletin de la Société Anatomique* (Sept. 1836), to which the reader is referred.

This hypertrophy of the uterine mucous membrane is of short duration.

For, as the ovum does not enter the uterus, it has no office to perform, and, therefore, like every other useless organ, becomes atrophied, loses its vascularity, and in a few months has returned to its usual condition. A gelatinous substance, a kind of thick, ropy mucus, is also frequently found in the neck of the uterus; but when the pregnancy has advanced beyond term, the womb gradually regains its natural condition. Finally, in certain cases, the calibre of the Fallopian tube has been found obliterated at some part of its length.

§ 2. Symptoms and Diagnosis of Extra-Uterine Pregnancy.

During the early months it is exceedingly difficult to recognize the existence of an extra-uterine pregnancy; for the modifications which then occur in the size, form, and consistence of the body and neck of the uterus, will certainly lead to error, and give rise to the belief of a true gestation. With regard to the menstruation and the lacteal secretion, no constant rule is observed. Sometimes the menses continue to appear; at others, they do not. In some instances this function is not re-established, even after the period when the accouchement should have taken place; and similar variations are met with in the secretion of milk. Again, menstruation has been known never to appear during an extra-uterine pregnancy which lasted more than thirty years, while the lacteal flow continued throughout the whole of that time.

There are, likewise, some abdominal pains, at a period not very distant from the date of conception, more or less analogous to the uterine pains, and at times a constant, fixed, circumscribed one in the pelvis, groin, or umbilical region. (The woman whose preparation I presented to the Anatomical Society, had on this account been treated for a partial peritonitis.) Not unfrequently there is an inability to lie upon one side. When the tumor, whilst still small, falls into the lesser pelvis, it pushes the uterus forward, the neck being directed in front and quite high behind the pubis. This displacement of the neck of the womb, together with the presence of a large tumor occupying the excavation posteriorly, and the dysuria occasioned by the pressure made upon the neck of the bladder, has been mistaken for retroversion. Several examples of this error are mentioned by Burns.

At a later period the tumor rises above the superior strait. The motions of the child are felt at the usual time, but they appear to be more superficial, and are generally felt on one side only.

The labor-pains come on at the natural term, or at the seventh month, or even sooner, generally lasting for three or four days, but occasionally much longer; and, should the pregnancy be unusually prolonged, they are apt to return at varied intervals, and again pass off.

Schmidt reports a case where the gestation lasted three years, within which period the labor-pains were renewed eight times, and on each occasion continued for several weeks.

In another gestation, of ten years' duration, the pains returned annually at the period corresponding to the term of pregnancy.

These pains are not produced by contraction of the walls of the cyst, as many have stated; because, excepting the cases of tubal and interstitial

pregnancy, they never contain any muscular fibres, and hence we must search for the cause in the uterus itself; for the great development exhibited by this organ, and the mucous and albuminous matters inclosed in its cavity, the expulsion of which requires some contractions, sufficiently account for the pains experienced by the patients. But it is exceedingly difficult to explain in a satisfactory manner their frequent coincidence with the usual term of gestation.

The physical signs which require our notice are, the changes in the uterine body and neck, just indicated, the more or less irregular development of the belly, and the possibility, in some cases, of distinguishing two tumors, one being the uterus, while the other is formed by the abnormal cyst.

In the sub-peritoneo-pelvic variety, the product of conception, by occupying the pelvic excavation, displaces and compresses the organs there situated, the vagina and rectum, for instance, and pushes them to one side. The vagina and rectum are found to be obstructed by a tumor situated between them, and frequently the different parts of the fœtus may be detected by the vaginal touch.

The fœtus seems to be much nearer the surface in the abdominal pregnancy than in either of the other varieties, hence its motions are more easily perceived, and are more distressing to the mother, and the forms of the different parts more clearly distinguishable. Besides, the rounded and regularly circumscribed tumor formed by the uterus in a normal gestation is not present.

In the tubal and ovarian varieties, says Baudelocque, the fœtal movements should be less vague, and its limbs more retracted. The body of the uterus is associated with the tumor formed by the fœtal cyst, and can neither be separated nor readily distinguished from it.

I have thus brought forward the various signs by which authors endeavor to detect the different species of extra-uterine gestation, although they have, in my estimation, but little practical importance; nor do I see that auscultation itself could render us much service in determining the diagnosis.

I ought to observe that the possibility of a fresh fecundation is a feature common to all the varieties of extra-uterine pregnancy.

Perhaps it may be serviceable to note that the vacuity of the uterus might be detected by the touch. Very frequently its habitual position will be changed by the pressure of the tumor, more especially when the latter occupies the excavation, and urges it against some part of the pelvic walls.

Finally, when by the usual signs we have become assured of the existence of pregnancy, and we suspect that it is extra-uterine, the diagnosis will be reduced to a certainty if we can determine the capital point, which is, that the uterus is empty. Now we have just seen that this knowledge can be arrived at by means of palpation and the touch. Professor Stoltz was the first to use the uterine sound for the same purpose; but it will be readily understood why great prudence should be exercised in deciding to employ it. In case of a normal pregnancy, the sound would, in fact, be almost sure to produce abortion, and then the mistake would be irreparable. The use of the uterine sound is more rational and truly useful when the question to be decided is, whether there be an extra-uterine pregnancy or a fibrous tumor of the uterus.

§ 3. PROGRESS AND TERMINATION.

It is but rarely that an extra-uterine pregnancy is prolonged beyond the fourth or fifth month; for generally the walls of the cyst give way, in consequence of their distention, before it has had time to become very large. Sometimes, however, the fœtal envelopes resist the pressure to which they are subjected, and if the fœtus itself do not perish through want of nourishment, or by some accidental disease, its development may progress until term, and it may even live for some time after the expiration of the ninth month. Such is reported by Dr. Grossi to have been the case with a lady, who, in all probability, carried an extra-uterine fœtus, whose motions were perceived clearly by himself and several consulting physicians, through a space of fourteen months. Usually, the child perishes either before or shortly after the term of pregnancy; and we shall now proceed to point out the possible consequences of its retention.

A. *Rupture of the Cyst.*—When left to itself, an extra-uterine pregnancy will generally terminate in a rupture of the cyst; but the time and consequences thereof are very variable. Were we to class these pregnancies according to the frequency of the rupture, and the early period of its occurrence, they would stand as follows: the tubo-interstitial, tubal, and abdominal.

It is very rare for the period of the rupture to extend beyond the middle term of pregnancy, except in the last variety. Dr. Lesouef very properly dwells on the tendency of tubal pregnancies to rupture at a very early stage of gestation. According to the same author, and to M. Bernutz, his master, if the rupture of the tube occurs at one of the points where it is covered by the peritoneum, the consequent effusion takes place into the peritoneal cavity; this, however, is not necessarily so, because the tube might give way at its adherent edge, and allow the ovule to slip between the two layers of the broad ligaments. In this case, the result would be a true consecutive sub-peritoneo-pelvic pregnancy.

The rupture, which is usually spontaneous, always gives rise to exceedingly grave phenomena, which may be described as the primitive and secondary consequences. Thus, the patient at once suffers from violent pains for several hours; then, after a pain which is much stronger than all the others, a perfect calm comes on. The abdomen sinks, or becomes flattened, and the former tumor disappears; a gentle and equal heat spreads over the abdominal cavity, and if the pregnancy is well advanced, the patient feels as though a voluminous body had been suddenly displaced; the skin loses its natural hue, faintings come on, the pulse is small and contracted, a cold sweat covers the whole body, and death frequently follows, because the rupture of the cyst is often the immediate cause of a hemorrhage that speedily proves fatal. Should any circumstance whatever arrest the hemorrhage, the first symptoms that follow the displacement of the product of conception, and the transference of the waters, blood, or even the fœtus itself, to parts not accustomed to such contact, are those of a very violent peritonitis. The patient generally dies, though sometimes she is able to resist the violence of the first inflammatory symptoms, in which case the course of the disease differs from that time, according to whether the debris

of the pregnancy are to be inclosed in a cyst of new formation for the remainder of the patient's life, or whether they are to be eliminated in various ways. In the first case, the fœtus may undergo all the transformations described under the head of the pathological anatomy; and in the second, the symptoms vary with the manner in which the elimination is effected.

B. *Prolonged Retention of the Cyst.*—As we have already stated, the peculiarities of extra-uterine pregnancy, when the integrity of the cyst allows the development of the fœtus to proceed until term, and even somewhat beyond it, we shall not reconsider it. We would, however, add, that in some cases the disorders of the general health, produced by the development of these abnormal pregnancies, have been so great as to prove fatal, without there being any discoverable lesion to account therefor. Thus, says M. Jacquemier, the autopsy reveals neither rupture of the cyst, nor a trace of hemorrhage, peritonitis, nor process of elimination going on in the cyst: the unfortunate sufferers appearing to have succumbed under a kind of exhaustion of vital power.

The development of the cyst ceases with the life of the fœtus, the circulation in its walls becomes feebler, the vessels which maintain the connections necessary to the support of the fœtal life, gradually become atrophied, and even in great part obliterated; so that the fœtus and its envelopes are thenceforth a foreign body within the organism of the mother. Occasionally, the latter becomes accustomed to their presence; for some women carry a fœtal cyst for many years without their health appearing to be much injured thereby: we have mentioned what transformations the fœtus and its envelopes are liable to undergo in such cases. Sometimes, however, the weight of the tumor, and the pressure which it exerts upon the neighboring parts, disturb the general functions so seriously as to make the female demand earnestly to be relieved of the cause of her suffering by an operation.

Whether the tumor be the cause of acute pain to the woman or not, it is likely, after the lapse of an indeterminate period, to become the seat of an inflammation, which extends rapidly to the neighboring parts. In consequence of this inflammation, which may progress with greater or less rapidity, adhesions are contracted between the walls of the cyst and the parts adjacent; ulceration begins at the points of adhesion, perforation follows with the formation of communications between the cavity of the cyst and that of one of the neighboring organs, or with the exterior, in case the abdominal walls be invaded by the ulceration.

The fœtal debris find their way to the exterior, at times by the bladder, rectum, vagina, and even the stomach, at others by means of an abscess opening into the perineum, or through the anterior abdominal parietes. Furthermore, since these latter communications are common to all kinds of extra-uterine pregnancies, we can understand that the situation of the fœtus in the sub-peritoneo-pelvic variety, which, as before stated, is the most deeply engaged in the excavation, will render its expulsion by the vagina or rectum more frequent than in the others.

Most generally some one of the above-mentioned organs serves as an excretory canal, but in certain cases several of them are simultaneously attacked by the adhesive inflammation; of course, ulceration and perforation soon

follow; and the wreck of the fœtus escapes at once by the anus, the vagina, and through a fistulous opening in the abdominal walls.

This expulsion greatly endangers the mother's life — for very often the inflammation and suppuration of the cyst, by spreading to neighboring parts, exhausts the patient, and sooner or later she succumbs. In the more fortunate cases, the sac is gradually emptied, cleansed, and contracted, the suppuration ceases, and the wound cicatrizes, or at least becomes a simple fistulous ulcer.

The long-continued suppuration, and consequent exhaustion of the patient's strength, will always render a complete expulsion of the foreign bodies highly desirable, for nothing else will put an end to the suppuration and allow the fistulas to close. Unfortunately, the hair, teeth, and pieces of bony substance adhere very strongly to the walls of the cyst, in which they seem to be imbedded, and are detached with difficulty; yet it is very necessary to be careful not to use too much force for their extraction, lest the walls of the cyst should be torn, and an opening made between it and the cavity of the peritoneum, rendering liable the occurrence of a quickly fatal peritonitis. The interference of the surgeon should be restricted to the dilatation of all the openings and fistulous passages by means of compressed sponge, to cleansing injections within the cyst, and to the withdrawal, by means of forceps, of the *completely detached* portions of bony matter which present themselves at the openings. In no case, I repeat, should any effort be made to detach the strongly adherent portions.

§ 4. Causes.

Nothing can oe more obscure than the causes of extra-uterine pregnancy, although numerous facts would seem to prove that the action of terror, coinciding with the time of fecundation, may produce such an effect as to prevent the impregnated ovule from being ulteriorly transported into the uterus; but notwithstanding the high authority of those who have adopted this doctrine, it does not appear to be admissible, since the ovule does not abandon the ovary at the moment of conception, but several days after or even several days before this event.

M. Dezeimeris brings forward one case that seems to prove that a blow on the hypogastrium a short time after a fruitful coition may be the cause of this anomaly, though I should rather refer it to a particular disposition of the mother's organs. When, indeed, we consider the narrowness of the tubal canal, we can readily conceive that any deviations, even slight ones, of the Fallopian tube, any paralysis or spasm, an excess or defect of length, an engorgement, the swelling and ulceration of the mucous membrane, or hardening of its pavilion, or any retraction at the internal orifice; in one word, all the anomalies and alterations described by authors may take place there, and give rise to it. I myself have had an opportunity of observing two cases (reported in the *Bulletin de la Société Anatomique*) in which the tube was obliterated between the point where the ovule was developed and the internal orifice of this canal.[1]

[1] The obliteration of the tube in the case referred to is so remarkable an occurrence, that I endeavored to learn, by referring to various authors, whether similar cases had

Finally, if we take into consideration the singular anomaly described by M. G. Richard (see page 86), we may suppose that the fecundated ovule

been reported. Most of them have not observed the state of permeability or impermeability of the tube; others, on the contrary, have given their attention to this point Thus, Smellie (vol. ii. p. 77) quotes an observation of Dr. Fern, in which an obliteration, or rather an excessive retraction of the tube was described. In the memoir of M. Breschet, on interstitial pregnancy, I found several instances where the obliteration of the uterine orifice was also noted. M. Mayer communicated a case to M Breschet, where the fœtus was developed in that part of the tube which traversed the substance of the uterine walls; M. Mayer further remarks, that the right tube was dilated at its fringed extremity, contracted in the uterine portion, and was completely obliterated at about three lines from the uterus; the left one, in which the ovule was developed, was permeable as far as the morbid mass, but from this point to the uterus the canal ceased. He adds: It is very probable that an induration of the uterine substance formerly existed at the insertion of the left tube, which caused the occlusion of its orifice, *and furnished an obstacle to the passage of the ovule.*

M. Schmidt reports that in an example of interstitial pregnancy, of six weeks, the internal orifice of the right tube was completely closed. (The ovule was developed on the right side of the womb.)

M. Menière (*Archives*, June, 1826) furnishes a case of interstitial pregnancy located in the left cornua, and he says the left tube was impermeable at its internal part.

M. Gaide, in a similar instance (*Journal Hebdomadaire*, t. i.), ascertained that the right tube had no uterine orifice.

Another case is reported in the *Archives* of a mortal hemorrhage produced by tubal pregnancy. The author adds: "The left tube (the ruptured one) formed a consistent membranous sac, and its free extremity embraced the whole ovary; below the dilatation and in the uterine portion, the canal was completely obliterated in such a manner that it was wholly impossible to reach the uterus through it."

From all which it follows, as a natural consequence, that, contrary to the opinion generally received, it is not necessary for the sperm to pass successively through the uterus and the Fallopian tube, so as to approach and fecundate the ovule; and, further, this conclusion permits the adoption of certain facts which have been rejected as improbable; for we can explain by it how, in some females, there may happen to be a complete occlusion of the os tincæ at the period of labor; how, in others, the fecundation has taken place without a proper introduction of the membrum virile, the physical proofs of virginity even remaining at the time of labor.

Perhaps comparative anatomy might throw some light on the question before us: thus, in certain mammalia, such as the hog, cow, &c., the Fallopian tube is not the only canal that affords a passage to the sperm; for M. Gartner, of Copenhagen, has announced the existence of a particular duct in these animals, which extends from the external parts through the substance of the broad ligaments. In 1826 he came to Paris, and, conjointly with M. de Blainville, made some new researches on this point, the results of which the French naturalist has communicated to the public in the *Bulletin de la Société Philomatique*, t. 9, p. 109, 1826. The latter says, that if the vagina of a young sow be carefully examined, a particular canal will be discovered, having its external orifices on each side of the meatus urinarius, and running through the muscular fibres of the vagina; it becomes contracted near the neck of the uterus, but does not the less continue in the uterine tissue. This canal at first follows the body of the womb, then abandons it, and runs in the substance of the broad ligament parallel to the corresponding cornua and close to the origin of the Fallopian tube, where it is lost by seeming to spread out, or to subdivide into two or three filaments, which can scarcely be distinguished from the vessels, and more especially from the proper tissue of the broad ligament.

M. de Blainville says he has searched in vain for similar canals in women, but he has not met with anything of the kind. Analogy, however, renders their existence probable in the human species; and this probability becomes still stronger from the

might, in its progress along the tube towards the uterus, escape through one of those accidental openings, and so fall into the abdominal cavity.

account of a case communicated by M. Baudelocque to the Académie de Médecine (*Arch. de Méd.* 1826), as a unique anomaly in the science, although it is a very singular fact that Dulaurens, according to the report of Mauriceau (*Traité des Maladies des Femmes Grosses*, p. 12, t. 1), had several times observed that the tube, after arriving at the angle of the uterus, separated into two distinct canals, the larger and shorter of which was inserted into the fundus uteri, while the other, being narrower and longer, terminated at the neck, near its internal orifice.

De Graaf (*Opera Omnia*, p. 212) thought he had found canals in women similar to those described by M. Gartner as existing in certain mammalia.

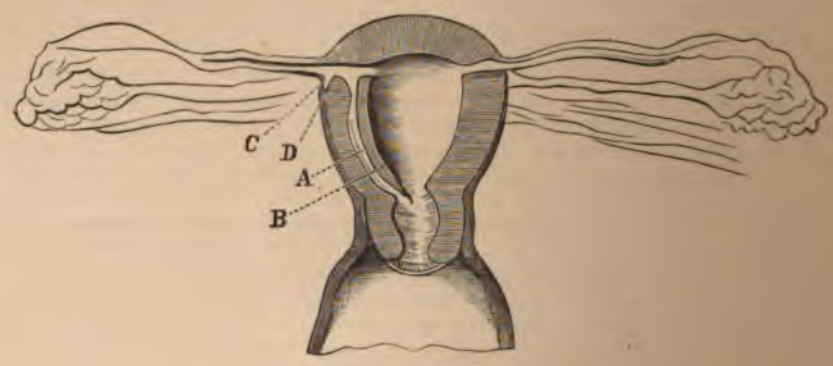
Lastly, Mad. Boivin declares she has met with cases analogous to the bifurcated canal of M. Baudelocque. Hence, in these examples at least, there is good ground for supposing that a conception may occur, even when the internal orifice of the tube is wholly obliterated.

Now if, as Mauriceau and Dulaurens say (whose researches the modern authors seem to have entirely overlooked), such anomalies were found at a period when dissections were much more rare than at the present time, we may conclude that, if the writers of our own day have not realized that disposition, it is because their efforts are not directed to the same end.

Among the causes of extra-uterine pregnancy mentioned by Parry, are pelvic inflammations, peri- and para-metritis, which produce constriction and displacement of the uterine appendages, peritonitis following previous confinement, pelvic abscess opening into the vagina. Numerous cases of extra-uterine pregnancy are cited in which previous inaptitude for conception, either primarily or after they have borne one or more children, existed.

Hernia of some portion of the internal genital organs, uterine displacements, an unhealed section of the uterus made in the operation of gastro-hysterotomy, a fistula through the cicatrix of the neck of a uterus, in which all of the body and part of the neck were removed on account of a fibroid tumor, are also mentioned.

Fig. 92a.



The illustration given above of bifurcation of the Fallopian tube, serves to explain a number of cases referred to as tubo-uterine; a notable instance occurring in the practice of Dr. Hodge is mentioned by Parry on page 266. A case reported by Dr. Gilbert, in the Boston *Medical and Surgical Journal*, March, 1877, as quoted by Lusk, page 314, belongs to this exceedingly interesting variety.

§ 5. TREATMENT.

It is evident that no operation could be attempted in the earlier months of pregnancy, even if we should be fortunate enough to ascertain with certainty that the ovule was not developed in the uterus. Frequent copious bleedings should be resorted to in such cases, for the double purpose of causing the death of the fœtus and of preventing too great a determination of blood towards the point at which the ovum is being developed.

It seems clear to me that not only does the constantly increasing weakness of the walls of the cyst, but also the local congestions so common during pregnancy, contribute to render rupture of the cyst more frequent.

Venesection, practised within the limits authorized by the general health of the patient, will be the more indicated here, as its unfavorable influence on the child's life is not to be dreaded, since its death is the most fortunate event that could occur.

This latter result may be obtained by passing electric shocks through the cyst. Dr. J. G. Allen, of Philadelphia, succeeded twice in causing the death of the fœtus by means of the Faradaic current. He applied one pole of an ordinary electro-magnetic machine to the tumor in the vagina through a glass speculum, the other placed upon the abdomen over the fœtal cyst.

Drs. Lovering and Landis reported a successful case in 1877, since which time others have been reported by Reeve, H. P. C. Wilson, and Lusk. In the case reported by Lusk, he succeeded after the tenth application, treatment beginning at the end of the tenth week, dating from the last menstruation.

Prof. T. G. Thomas reported in the *New York Med. Jour.*, June, 1875, a case of tubal pregnancy of three months treated successfully by cutting into the sac through the vaginal wall by means of the platinum knife of the galvano-caustic battery. There was no blood lost until efforts to remote the placenta by gentle traction and detachment brought on a severe hemorrhage. A little over half of the placenta was removed when he was obliged to inject a solution of persulphate of iron. Symptoms of septicæmia set in on the fourth day, which, however, yielded to constantly-repeated injections into the sac of carbolized water. The remaining portion of the placenta came away spontaneously on the fifteenth day.

The operation devised by Dr. Thomas promises very great success in the treatment of extra-uterine pregnancy in the early stages. It has the advantage of less risk to the peritoneum, less danger from hemorrhage, it insures drainage of the sac, more thorough disinfection, and therefore less danger from septicæmia.

More recently he advises leaving the placenta *in situ* and filling the sac with antiseptic cotton, which should be removed once in thirty-six hours.

If no obstacle can be opposed to the constant development of the fœtus, every operation must be proscribed at this period for extracting the fœtus from its mother's body, because an operation would be as dangerous as the anticipated accident. Even when the spontaneous rupture of the cyst,

during the early stages, occasions a just fear of mortal hemorrhage, we can only employ those general means which are the best calculated to prevent profuse discharges, such as rest, refrigerants, etc. Again, supposing that a well-marked case of extra-uterine pregnancy has advanced almost to term, or that the labor has actually commenced, we may still justly dread the laceration of the cyst as a consequence of the expulsive efforts; and the question then arises whether gastrotomy, which has been successfully practised in similar cases, ought to be resorted to. If the child's safety be alone considered, this question is easily resolved. But is not the life of the mother almost necessarily compromised by such an operation?

How shall we persuade the patient, when the proper period for operating has arrived, if she herself does not suspect the danger she encounters by refusing? Or how, indeed, can we ourselves decide, when the possible consequences are foreseen, the whole difficulties of a delivery appreciated, and the necessity staring us in the face of leaving open in the abdomen a vast cyst, the inflammation and suppuration of which are so difficult to dry up, and are of themselves sufficient to endanger the sufferer's life?

In such cases, who can doubt, says M. Dezeimeris, that if there was any measure at all that could suspend the commencing labor, the ties of humanity alone would render its employment a duty? And I fully embrace the same opinion.

Now among the means calculated to restrain the ordinary uterine contractions, I know of nothing more serviceable than opium, when exhibited in large doses per anum, and I certainly should not hesitate to employ it under these circumstances; but if the labor continues, notwithstanding its use, gastrotomy may then be authorized.

The cyst is generally opened through the abdominal parietes, the place of selection being the same as in the common Cæsarean operation, though, in case the head be felt through the vagina during the expulsive efforts, less danger would certainly accompany an incision through the walls of the latter. The child may be extracted by turning, or by the forceps, if necessary. Parry collected 15 cases in which vaginotomy was performed. In these, nine of the mothers died and six lived—a mortality of 60 per cent. In primary gastrotomy the mortality is 70 per cent. The death rate of extra-uterine pregnancy, not actively interfered with, is shown to be 52.65 per cent.

If a prolonged labor has produced a rupture of the cyst, it is very doubtful whether gastrotomy could be successful. The first efforts should be directed towards moderating the hemorrhage, and opposing consecutive inflammation should be energetically employed.

But the primitive phenomena once calmed, whether there be a rupture or not, our art may evidently interpose to prevent the consecutive accidents that have been enumerated, and which compromise to so great an extent the health and even the life of the patient. When the inflammatory symptoms have ceased, it is proper to wait; and especially after the cyst is ruptured, hasty action becomes unnecessary.

In fact, a considerable period is requisite in such cases for the development of a new cyst around the displaced parts, and a certain length of time

is necessary for the adhesions to form between them and the adjacent parts, and it would be exceedingly rash to interfere with this salutary action by any inopportune operation on our part. In old abnormal pregnancies, the resources of art vary with the particular case. Sometimes, indeed, an eliminatory effort has already commenced by an inflammation of the integuments placed just in front of the tumor, whereby an abscess is formed; and the only question then is, whether to open it, or by suitable incisions to enlarge the spontaneous solutions of continuity; in either case we encounter a vast abscess, which must be emptied and cleansed by the usual methods.

When some portions of the fœtus get into the bladder, and we are assured of that fact by the use of the catheter, the operation for stone may be practised either through the vagina or by the hypogastrium. Again, a woman may present herself with an extra-uterine fœtus of one or several years' standing. Can the resources of art afford her any relief? We reply, that if the gestation is a source of severe suffering, and it renders her incapable of discharging her duties; and if, besides, the tumor may be reached through the vagina without difficulty, the vaginal incision should doubtless be performed. But if she is otherwise in good health, would it be prudent to interfere for the mere purpose of anticipating the accidents to which she will probably be afterwards exposed? Or is there any ground for hoping to extract the fœtus *en masse*, by a prudent and methodical operation? This last question is far more difficult to solve. In a case of this kind, where the head of the fœtus, from being wedged at the superior strait, could readily be felt through the posterior superior part of the vaginal parietes, I knew Professor P. Dubois (notwithstanding sharp opposition from several of his brethren in consultation) to resolve upon incising freely the vaginal wall, as well as the cystic envelopes, intending to apply the forceps on the head, and thus extract the fœtus bodily; but the walls of the cyst and vagina having been cut through, an intimate adhesion was discovered between the former and the fœtal head, which caused the operation to be abandoned. It was not without benefit, however, for in the course of a few days it was followed by the discharge of a putrid mass, comprising all the soft parts of the fœtus; the detached bones of the skeleton were gradually extracted by the aid of long pincers, and frequently repeated injections; the cystic walls contracted slowly; and when, at length, nothing remained, and the parietes were cleansed, the opening gradually closed up, and by the end of two months the patient was completely cured. At the time of operating she had been pregnant twenty-two months. This plan ought to be followed up in similar cases, especially if the female's health is visibly affected. Incision by the rectum has been practised in some few instances where the vulva was obliterated. Finally, gastrotomy alone would be practicable when the fœtus, from its high situation in the abdomen, is inaccessible by the vagina or rectum. This operation must be regarded as the last resource when the patient's life is seriously endangered.

In 1875, Prof. T. G. Thomas reported a case successfully operated upon through the vagina by means of the platinum knife of the galvano-caustic battery. In all operations, antiseptic precautions should be used.

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